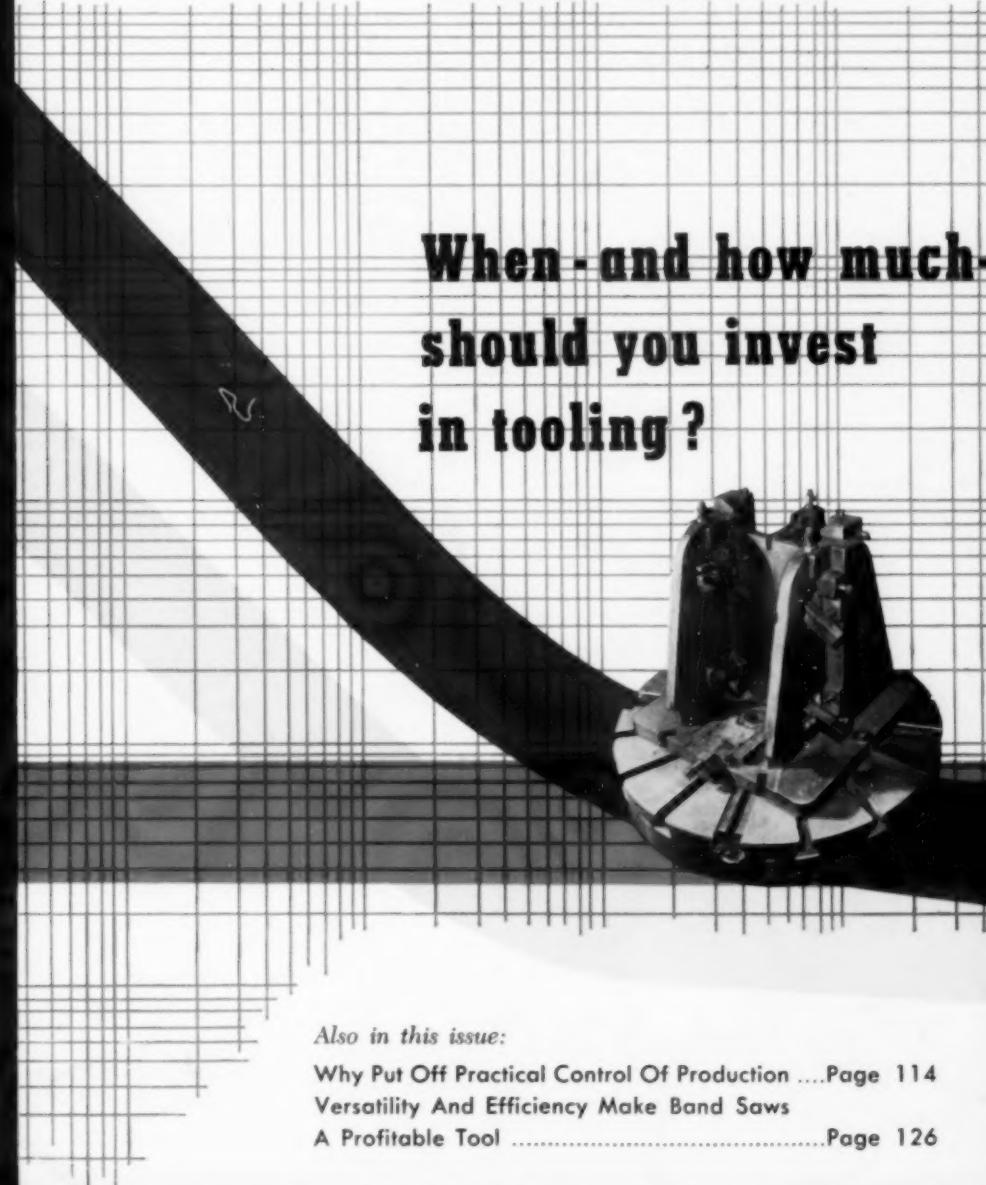


# Machine and Tool **BLUE BOOK**

*A Hitchcock Publication*

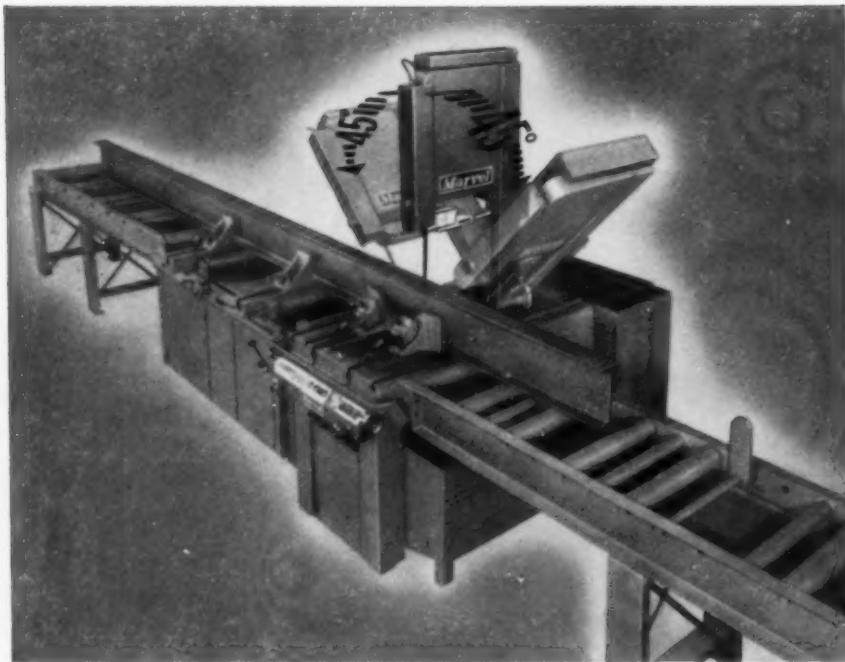
OCTOBER · 1960



**When - and how much -  
should you invest  
in tooling ?**

*Also in this issue:*

Why Put Off Practical Control Of Production ....	Page 114
Versatility And Efficiency Make Band Saws	
A Profitable Tool .....	Page 126



## ***Tips Its Head To Cut Production Corners***

Sawing 45° miters in any kind of material has always been a simple task for MARVEL Saws, but moving the work up automatically and making consecutive cuts on an angle was a problem, especially when the work was long and cumbersome.

This triple exposure photograph of a new MARVEL No. 81A All Hydraulic Heavy Duty Automatic Bar Feed Band Saw, illustrates how the upright head or column can be tipped 45° either right or left of vertical to make angle or miter cuts. The work is held stationary while the column, which carries the blade, is fed forward, meeting the work squarely to insure accurate cutting. After the cut is completed, the work is automatically moved up and measured, and another cut made.

Automatic miter cutting is just one of many exclusive universal features of these band saws. Designed to utilize every advantage of high speed steel band blades, MARVEL No. 81 Series Band Saws can handle almost any conceivable sawing job—from the smallest, most delicate work, up to 18" x 20" shapes.

Only the MARVEL No. 81 Band Saws have the "SURE-LINE" Automatic Accuracy Control (basic patent applied for) which literally steers a blade to make a straight cut. This unit extends usable blade life as much as 50%.

MARVEL No. 81 Series Band Saws are proving themselves daily, as the most versatile machine tools in production metalworking plants.

For complete details, or a demonstration of MARVEL Sawing Equipment, write: Armstrong-Blum Manufacturing Co., 5700 W. Bloomingdale Ave., Chicago 39, Ill.

**MARVEL** Saws

# P.D.Q. TOOLS PACE INDUSTRY...

## ★ LAYOUT MACHINE

Save up to 80% on layout time. Lays out all four sides, top, bottom and inside in one set up.



## ★ QUICK CHANGE TOOLS

Holders and adapters for every machine use.



## ★ SURE BORE

Micrometer adjusted —Carbide Tool Bits, Boring Bars and Heads



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Cuts Keyways to size with UNDERSIZE end mills



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and cut-off machines



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3/8" to 6" Dia.  
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... quick setting



## ★ MILLING CUTTERS

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handle the toughest jobs.



Literature is available  
on all tools illustrated



## PORTAGE Double-Quick TOOL CO.

1037 SWEITZER AVENUE • AKRON 11, OHIO

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October, 1960

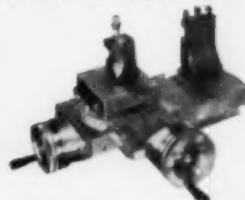


SOME OF THE MANY  
COST-SAVING FEATURES



**RADIUS TURNING  
ATTACHMENT**

Concave and convex surfaces are readily generated after a simple set-up with a direct-reading dial indicator. Worm gear feeding insures a finely controlled finish.



**REAR SLIDE CUT-OFF**

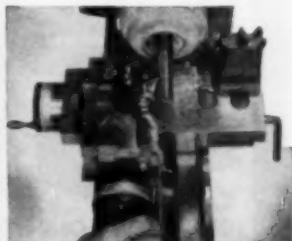
The rear tool station is an added feature to the traditional convenience and accuracy of the Wade Super Slide Rest. A cut-off tool may be left in readiness to avoid tool changing.

*Cut toolmaking costs*  
with a **Wade**  
**#94 FINISHING LATHE**

Every design feature built into the Wade Finishing Lathe has one aim in view: to make this machine the *most convenient and the fastest to use* for toolmaking and limited production. The Wade Model #94 has a 9" swing, 1-1/16" collet capacity and will accept 15" between centers.

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Large satin-chrome dials read directly in thousandths of an inch and are resettable to zero.

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PRECISION MACHINE TOOLS  
FOR AMERICAN INDUSTRY

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## NEW GISHOLT 3F FASTERMATIC WITH

**FeedDial  
CONTROL**



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...then set your tools and take your trial cuts. That's how fast and simple it is to set up the new Gisholt MASTERLINE 3F FASTERMATIC Automatic Chucking Turret Lathe!

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Completely automatic—But your savings don't end with fast setup. The automatic cycle assures consistent quality at fixed production rates. Any operator, even a new man, can chuck the work, start the cycle and remove the finished part. He has ample time to handle another machine.

What's more fast setup makes the new 3F pay off big on machining small lots—25 to 50 pieces—as well as long production runs. Contact your Gisholt Representative, or write us.

Send for literature—Ask your Gisholt Representative to show you how this new 3F with FeedDial can cut costs on your work.



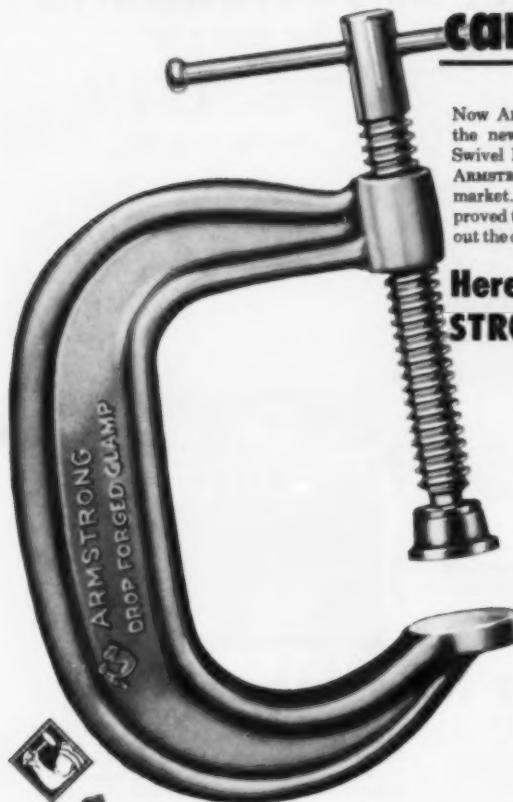
Turret Lathes • Automatic Lathes  
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Madison 10, Wisconsin

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# New **ARMSTRONG** Swivel Pad can't come off



Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

**Here's Why it's  
STRONGER.**



The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer — yet the pad is free to swivel through an arc of approximately 40°.



**Call your ARMSTRONG Distributor**

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

## **ARMSTRONG BROS. TOOL CO.,**

5208 W. ARMSTRONG AVE.  
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# Machine and Tool

# BLUE BOOK

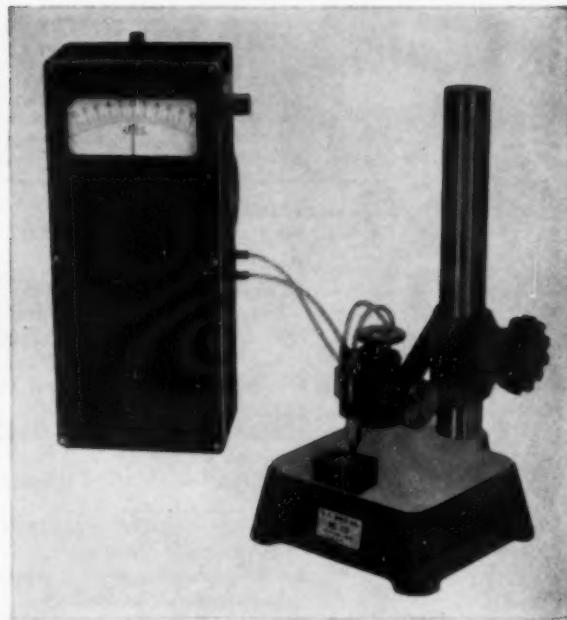
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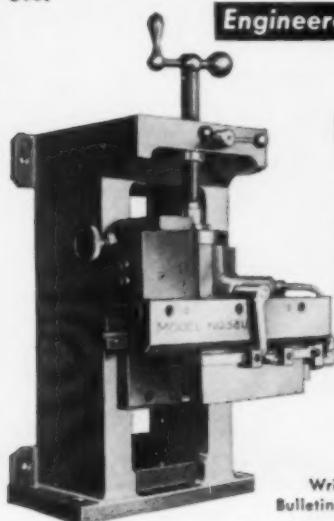
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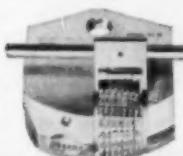


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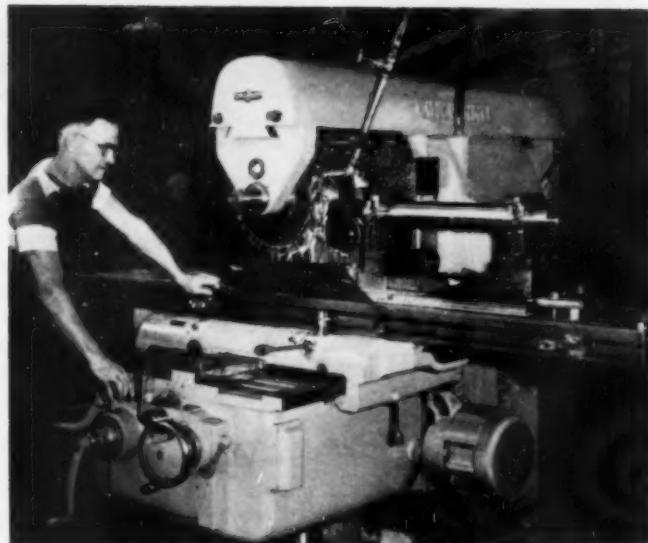


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MMT-PE



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# The BIG DIAL TYPES

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Photo courtesy of E. W. Bliss Company

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October, 1960



*variable speeds 60 to 3300 r.p.m.*

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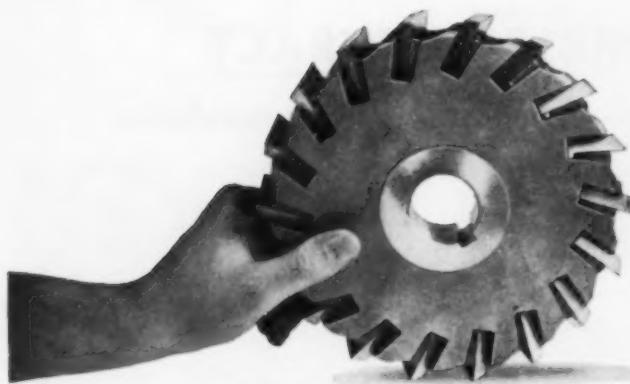


At the same time, ask for information on Hartford Special's lines of Air Hydraulic Drill Units, including the all-new Model 17-400.

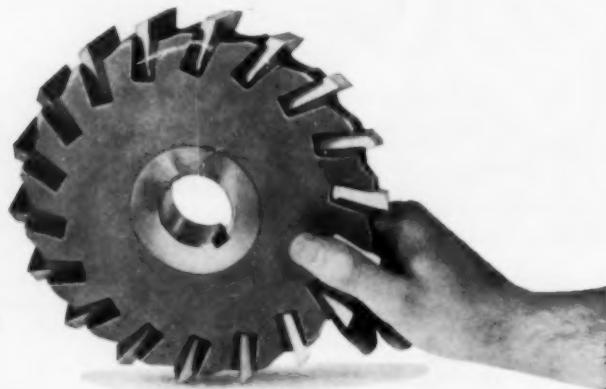
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*Special*

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MODEL 36 for parts up to 14½" dia.



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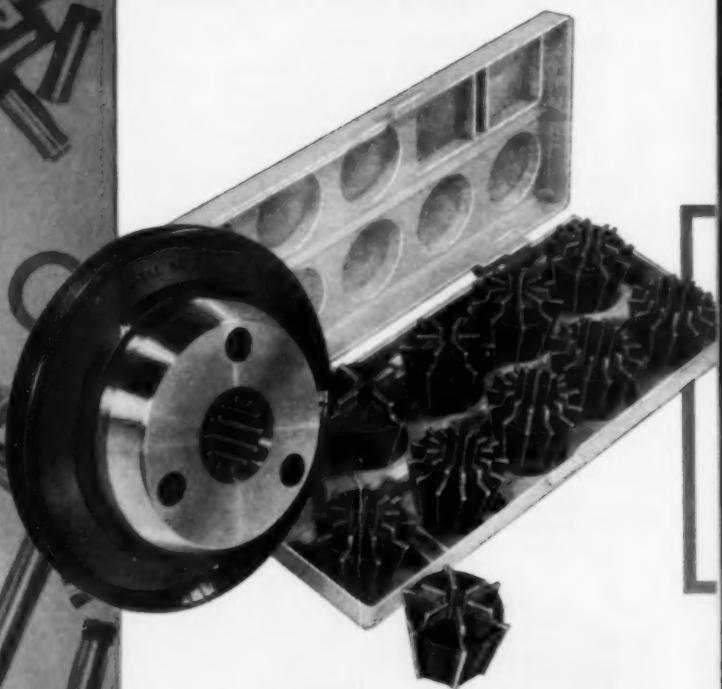
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PRECISION LAPPING ON A  
PRODUCTION BASIS

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**\$70<sup>00</sup>**

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Complete Set of  
10 Rubber-Flex Collets

# You get a lot more for less!

model

# 50

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- is quicker to operate
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- increases lathe capacity
- mounts directly onto your spindle
- costs less . . . less . . . less . . .

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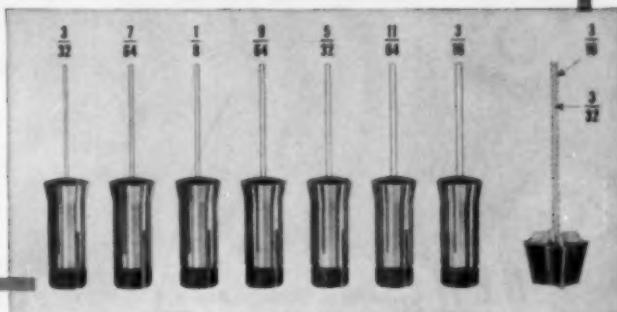
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for the chuck!

**\$65<sup>00</sup>**

for the collets!

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An entirely new series of ten Jacobs Rubber-Flex Collets has been developed along with the world's most modern collet chuck. Rubber-Flex collets do more because:

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**How one Rubber-Flex collet  
replaces seven split steel collets**

This is the chuck,  
these are the collets,  
for your . . .

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SHELDON • SOUTH BEND  
... lathes

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NEW



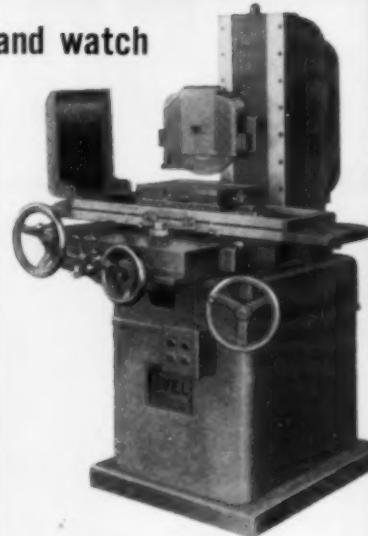
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AUTOMATIC SIZING AND CYCLING  
—ELECTRONICALLY CONTROLLED

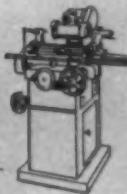
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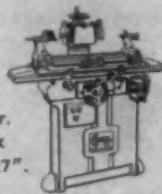
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LOW-COST HIGH SPEED HYDRAULIC

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Swings work  
8" dia. x 16".



No. 12A  
Universal  
Cutter and  
Tool Grinder.  
Swings work  
10" dia. x 27".



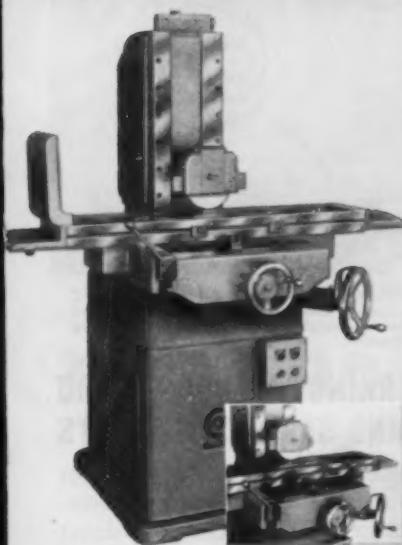
No. 7A  
Hand Feed  
Surface  
Grinder,  
6" x 12".



No. 80  
Hydraul  
Surface  
Grinder,  
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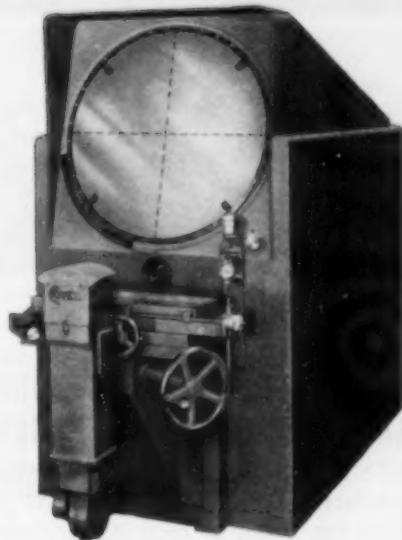
Tool Exposition in Chicago...

## TO PRODUCTION EFFICIENCY



**NEW** Surface Grinder with  
POWER-ASSIST HAND FEED

See and operate this revolutionary new hand feed that permits table speed and direction to be controlled exactly as you want them with the effortless ease of power steering.



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THIRTY-INCH SCREEN

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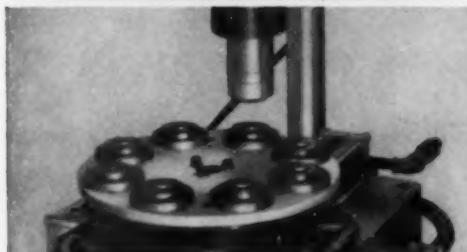
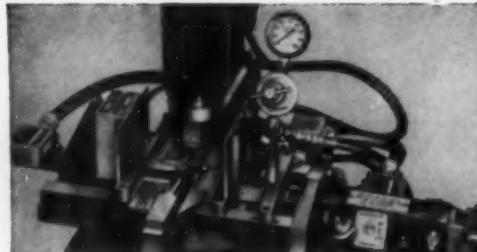
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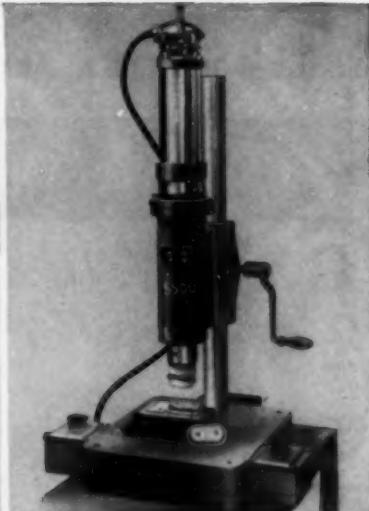
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October, 1960

17



ABOVE, TOP: 10T with stacker feed marks 3000 to 3600 nameplates per hour.  
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GTS Machines prolong marking tool life, lowering your tool costs.

GTS experience can *solve* your marking problems. Let our Marking Engineers help you determine the best methods for you.



For sharp impressions and long-run economy, always specify GTS Marking Tools.

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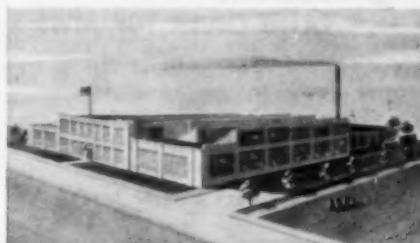
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machine components  
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**P. O. BOX 750 • COLUMBUS, OHIO**

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October, 1960

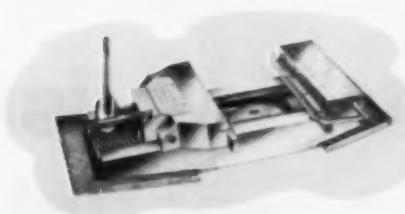
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You get day - in  
with J & S

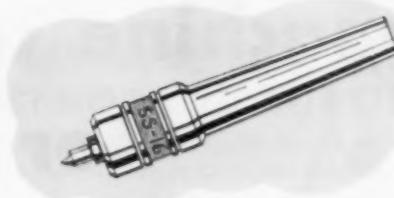
**10. J & S CLAMPCUT  
SWIVEL VISE**

Highly versatile milling machine vise with all the features which permit faster operation, fewer rejects, more man-hours saved.



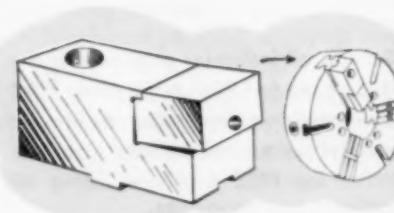
**11. SUPER SENSITIVE SS-16  
LIVE CENTER**

For grinders and lathes. Designed to handle the smallest parts with highest precision. Non-friction center is free to rotate at the slightest touch.



**12. DOWN-HOLDING  
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With expendable soft inserts. Cheaper jaws to be used up; thrown away. Provide tighter clamping for parallel machining work. Mount on any American Standard Lathe Chuck Master Jaw.



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## J & S CLAMPCUT SWIVEL VISE FOR BETTER MILLING

With all the features for faster, better milling, this modern swivel vise is available in a complete range of sizes. Low, flat mounting, extra jaw depth, trigger stop for rapid opening and closing, multiple downholding clamp action, self-cleaning snap-on parallels for fast load-unload, plus positive chip escape and coolant return are among the advantages of this versatile J & S Swivel Vise which holds on any angle, holds rounds and allows extra height.

---

## SS16, J & S SUPER SENSITIVE LIVE CENTER

One of the stars of J & S' complete live center line, the SS16 is designed to handle parts with .100" diameter and smaller. It has a neoprene seal and high speed point. The non-friction center rotates at the slightest pressure, is hardened and ground throughout.

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## UNIQUE DOWN-HOLDING LATHE CHUCK TOP JAWS

These new J & S jaws are another of the forward steps in modern methods of securing workpieces to machine tools. The soft expendable inserts mean cleaner jaws which can be used up and thrown away. They provide more rigidity, accuracy and parallelism; they clamp tightly and hold down a workpiece to a stop for utmost accuracy in machining work parallel.

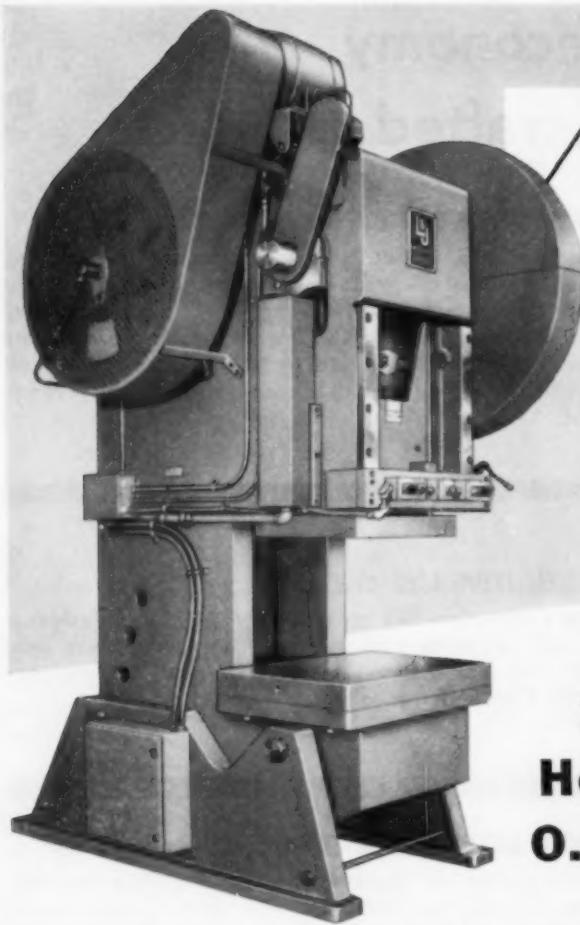
Literature and data on request.

Specify product No. listed opposite illustration.

**J & S TOOL CO., INC.**

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WYman 2-3181



## 125 Ton Heavy Duty O.B.I. Press

### STANDARD EQUIPMENT

Air clutch and brake. J.I.C. controls. Dual air valves. Adjustable gibs. Hard bronze crankshaft bearings. Forced lubrication.

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- 125 ton capacity covers wide variety of jobs.
- Big die capacity—bolster area 42" x 29"—shut height 18", or to suit.
- Versatile—efficient—dependable.

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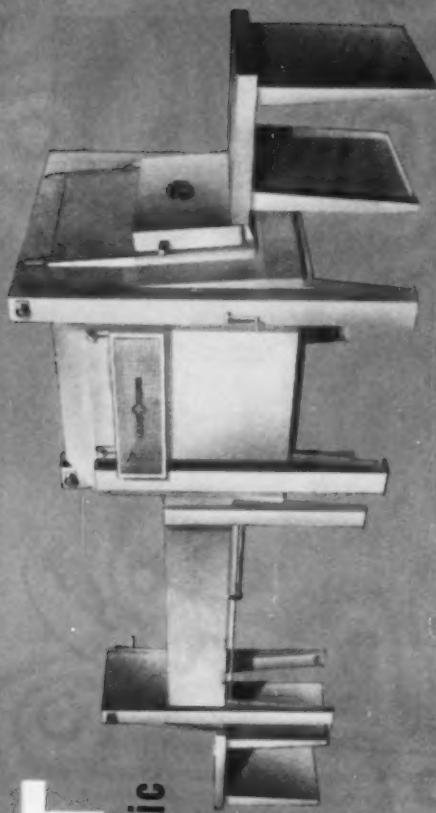
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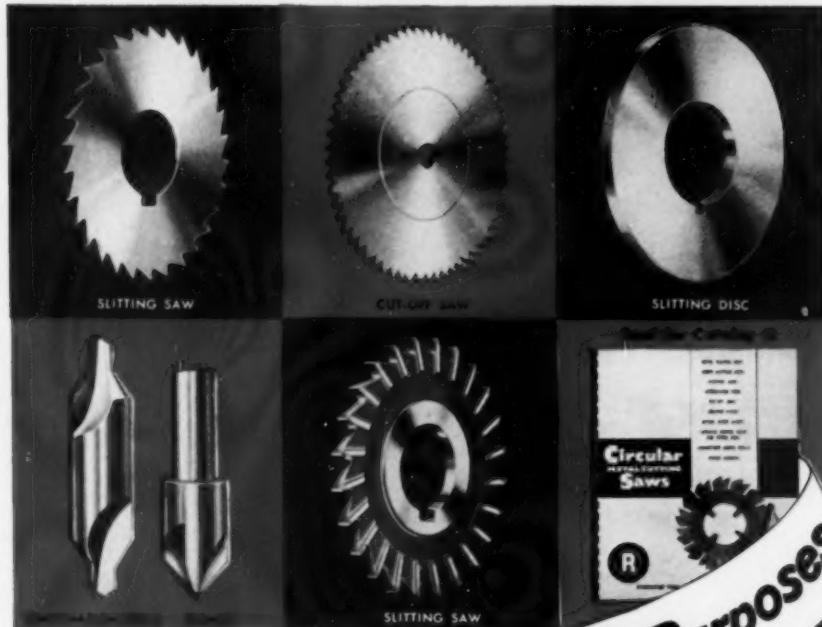
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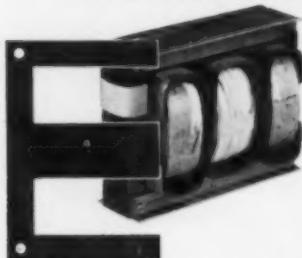
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Cleveland Tool and Die  
**CASE FILE**

## "12 to 15 TIMES LONGER DIE LIFE"

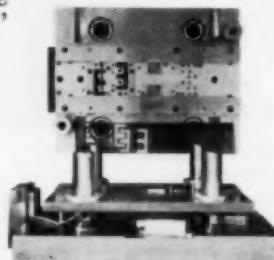
CTD PRECISION CARBIDE DIES SPEED OUTPUT OF "FRANCEFORMER" LAMINATIONS



tungsten carbide dies. "CTD dies give us continuous production with far less downtime," says Emil Olds, plant manager. "We get 12 to 15 times the die life at only 3 times the previous cost."

ANOTHER EXAMPLE  
OF THE IMPORTANT  
PRODUCTION EFFICIENCY  
MADE POSSIBLE BY CTD  
PRECISION CRAFTSMANSHIP

Check the transformer on the next neon sign you see, and chances are it'll read "Franceformer" — trade mark of the France Mfg. Co. of Cleveland, O. This aggressive company supplies leading jobbers of neon signs throughout the country. For high-speed lamination production, France chooses CTD precision



**C**leveland **T**ool and **D**ie *means precision...*

Send for brochure describing CTD's plant and facilities.



*Dies, Jigs, Fixtures and  
Special Purpose Tooling*

**Cleveland Tool and Die Co.**

30510 Lakeland • Willowick, Ohio

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IT'S A FACT!

## DRILLHEADS ARE OBVIOUS.

### THOMSON THRIFTMASTER

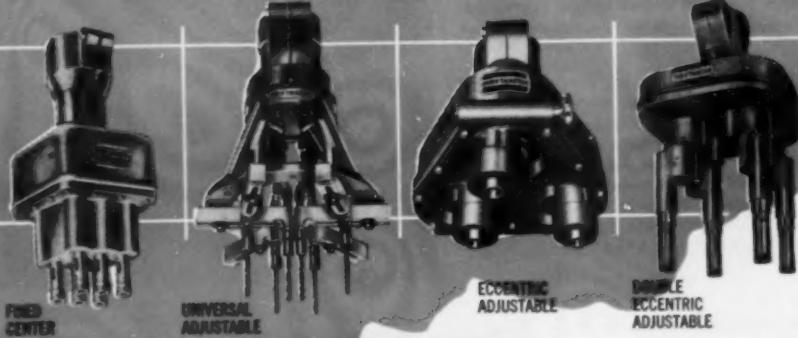
Drillheads  
are your best Drillhead buy...

Tremendous economies from the use of multiple-spindle drillheads are obvious. Drilling one hole at a time cannot be tolerated in this day of automation!

1. They are better built and cost no more (Full ball bearing construction, hardened gears, spindles and driver, and precision grinding!)
2. This means they last longer
3. This eliminates down time
4. This eliminates production losses
5. This drastically reduces drilling costs

### THOMSON THRIFTMASTER

1923. This long accumulation of engineering technique and production "know-how" is reflected in our product—a quality tool... solid, substantial and dependable!



DRILL • TAP  
REAM • BORE  
COUNTER • BORE  
COUNTER • SINK  
FACE...with  
THRIFTMASTER



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# DRILL PRECISION HOLES FASTER

## Burgmaster Bench Model Automatic Turret Drill

### With Manual Positioning Table and Power Feed

#### GREATLY REDUCE TOOLING COSTS

Burgmaster Bench Model 6-Spindle Turret Drill equipped with Manual Positioning Table and Automatic Power Feed, is a combination that greatly increases production and slashes tooling costs by eliminating expensive jigs and fixtures.

#### MANUAL POSITIONING TABLE

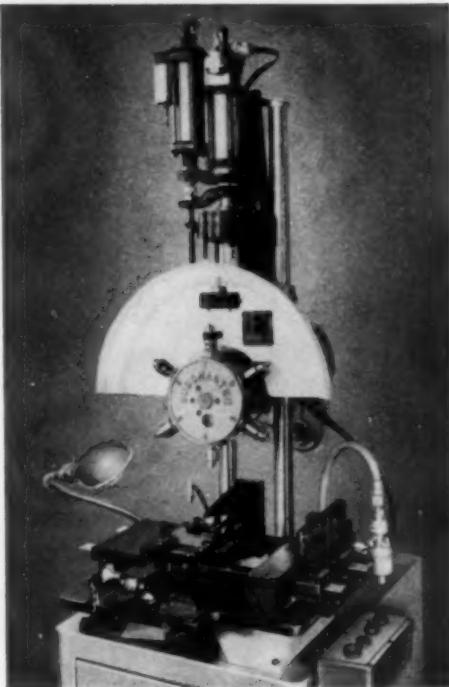
The free floating table mounted on ball bearings permits rapid, effortless positioning by pointing to a hole center on the Master Pattern. Releasing a thumb button on the Operating Handle locks the table at each position within .0005" and also initiates the automatic feed stroke of the turret. The turret returns to "top stop", and at the next table position, repeats without indexing unless cycled by the operator's push button on the control panel.

#### PRE-SET POWER FEED

A solenoid controlled air motor and Hydro-chek allows preset infinitely variable positive feed rate, with fully adjustable rapid down and return from point of hole entry. The unitized control panel is side mounted and provides a Function Selector for OFF, MANUAL and AUTOMATIC, with separate EMERGENCY UP and START buttons.

#### TYPES OF OPERATION

1. Manual—operation with Power Feed
2. Semi-Automatic — Cycling through a predetermined set of operations—load and unload manually.
3. Fully Automatic — Cycles automatically using shuttle tables, index tables, hopper feeds, etc.



#### ALL FOR LESS THAN THE COST OF SIX SPINDLE PRODUCTION TABLE DRILL PRESS

Capacity— $\frac{1}{4}$ " drill and tap in steel. Why not investigate further how the Burgmaster Bench Model Automatic Turret Drill with Manual Positioning Table and Power Feed can save you money. Write today for free literature.



#### BURGMMASTER CORPORATION

SMALL TOOL DIVISION—BURG TOOL MANUFACTURING CO., INC.

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World's largest manufacturer of turret-type drilling and tapping machines.

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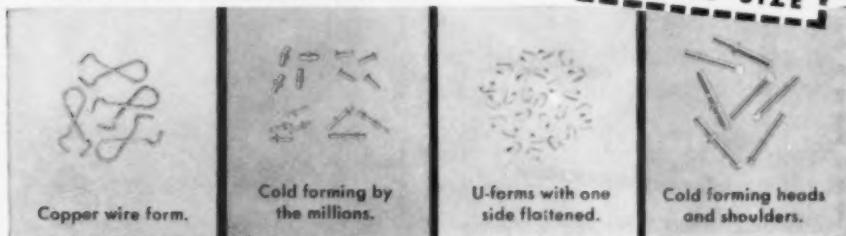
# PRECISION MINIATURE PARTS PRODUCED WITH SPEED & ECONOMY on a NILSON #00 FOURSLIDE MACHINE

Up to 10,000 parts/hour — miniature electrical, electronic or mechanical components made of ferrous, non-ferrous, alloys, Kovar, Rodar and precious metals.



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ACTUAL SIZE

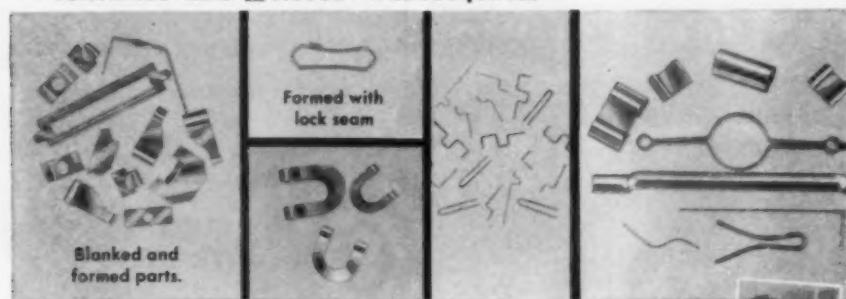
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diameters on NILSON #00 Fourslides.



## RIBBON METAL FORMING.

Tolerances held  $\pm 0.0005"$  when required.

Parts are shown through courtesy of  
Art Wire & Stamping Company  
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FOURSLIDES.



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October, 1960

29

# MACHINE TOOL

# MARKING TOOL

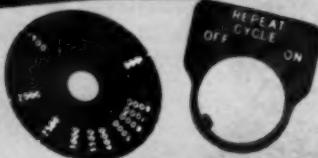
## ENGRAVOGRAPH is both!

*"The skill is in the tool, not on your payroll"*



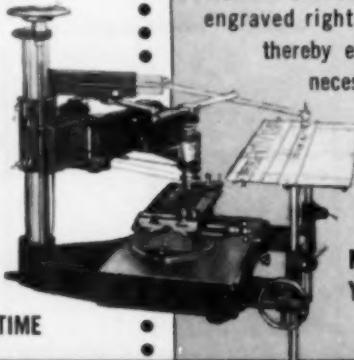
Vertical Milling...Profiling...Slotting...Drilling: With Engravograph, this shape was profiled and the holes were spotted and drilled in one set-up, from one master template, eliminating expensive tooling, multiple operations on costly equipment.

MAKE IT IN A  
FRACTION OF  
THE TIME



• 213B •

Engraving Nameplates...Marking parts and panels: With Engravograph, any nameplate, panel or tag can be engraved right in your own shop, thereby eliminating much unnecessary subcontracting.



MAKE IT WHEN  
YOU NEED IT

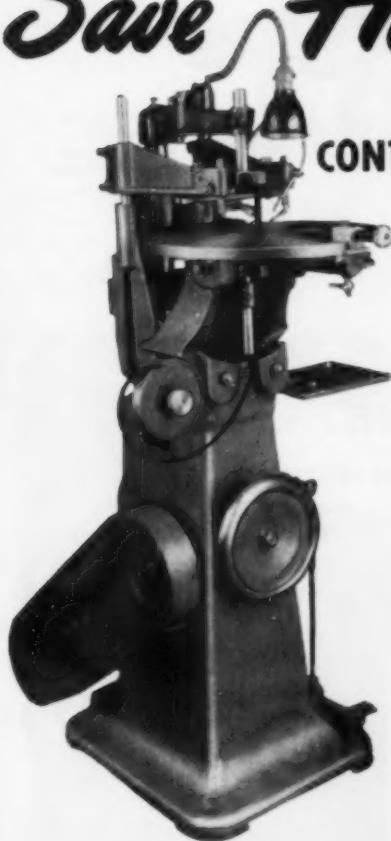
Write on your letterhead  
for 28 page catalog MM 7

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IN CANADA 159 St. James Street West Montreal, P.Q.

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MACHINE and TOOL BLUE BOOK

# Save Hours in tool rooms and die shops with **CONTOUR SAWING AND FILING**



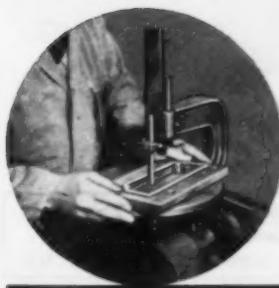
You can save real time and money in the production of parts for jigs and fixtures, dies, gages, templates and special machine production by using an Oliver of Adrian contour sawing and filing machine.

The Oliver is so simple to operate that all sawing, filing and lapping can be handled by an ordinary mechanic—saving a skilled die maker's costly time. Parts can be shaped to dimension faster, more accurately with no hand filing or semi-finishing operations. Available in five types—bench or pedestal. Write today.

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**LK**

You can do . . . .

**Jig Boring . . . .**



20 Spindle Speeds—40-3150 rpm.  
Head tilts 90° either side of vertical.

**Jig Grinding . . . .**



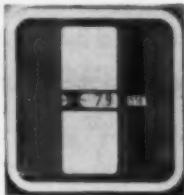
Infinitely variable  
Spindle Speeds—  
15,000-60,000 rpm.  
Head tilts 45° either  
side of vertical.

by a simple change of heads

on the same

**BASIC MACHINE . . . .**

with Direct  
Numerical  
Readings  
to 0.0001"



The Deckel LK, with interchangeable heads for optical coordinate jig boring and jig grinding, provides extreme precision with Economy! The heads are easily changed for either operation, and each gives you equally precise performance.

Coordinate worktable settings are read directly, in numerals, to ten thousandths—0.0001". Reading or setting errors are practically impossible! Actual table positioning accuracy is 0.00012", with longitudinal, vertical and transverse quick-traverse.

To protect the inherent accuracy of the Deckel LK, a thermal expansion compensating device is built into the column. Further protection is provided by heat dissipation from gear box and motor.

Write today for information

Deckel LK has a worktable clamping area of 25 $\frac{1}{2}$ " x 11 $\frac{1}{2}$ " and a range of coordinate readings of 15 $\frac{1}{4}$ " x 10".

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**Importers of Leading Precision Machine Tools**

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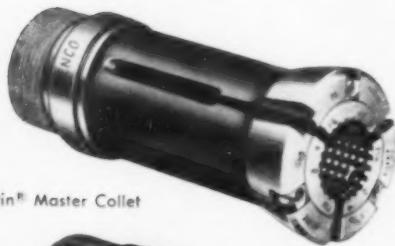
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**BENCO COLLET MANUFACTURING CO.**

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# NEW



## COIL GUARD band saw dispenser



EASIER TO STOCK,  
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- ★ Coilguard is designed and engineered to guarantee smooth easy dispensing and recoiling. Cut end does not protrude.
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- ★ Two-way labeling permits identification when stacked vertically or flat.
- ★ Special nesting pins allow "shoulder to shoulder" stocking.
- ★ Hex shape prevents rolling.
- ★ Through center hole facilitates handling, is ideal for mounting on pegs or pipes for dispensing.

Only Capewell Distributors carry bandsaws in the convenient Coilguard package. One more reason why your Capewell Distributor should be your source for all the saws you need—hand hack saws, power hack saws, band saws and hole saws.



**THE CAPEWELL MFG. CO., HARTFORD 2, CONN.**

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A NEW "*COMPACT*" HITS THE MACHINE TOOL FIELD...

# THE NEW HARIG 612

## SURFACE GRINDER

with

- \* **Automatic forced lubrication**  
goes into operation as soon as machine is started — triples life of the ways and preserves original accuracy.
- \* **Direct drive spindle**  
increases power . . . reduces vibration . . . no V-belts to replace.
- \* **Your choice of right or left hand longitudinal feed**

### *All Standard Equipment*

The new 612 represents a break-thru in design and construction whereby Harig now offers industry a low-cost, precision surface grinder loaded with features usually found only on expensive models. Easy to operate . . . requires little maintenance . . . built with the precision quality you expect from Harig.

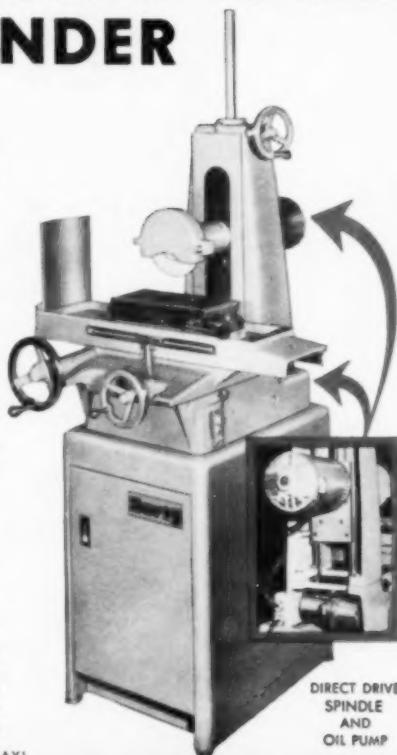
NOW! FAST-ACTION VISES FOR  
PRODUCTION and TOOL ROOM  
HARIG "JAWSET" • "RAPID SET"

WRITE FOR HARIG 612 OR NEW VISE BROCHURE TODAY!



#### HARIG'S NEW IMPROVED GRIND-ALL FIXTURE

Easily grinds irregular shaped performers concentric with shank within  $\pm .0001$  accuracy. Also can be used as milling, boring and inspection fixture. NEW ATTACHMENTS: Radius Dresser Arm and Ball Seat Punch Adapter. [Write for new Grind-All Brochure.]



DIRECT DRIVE  
SPINDLE  
AND  
OIL PUMP

**Harig**  
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When plant officials today are faced with a die construction or tough metal-piercing problem, chances are you'll find a place at their discussion table reserved for the man from Richard Brothers.

Our consulting engineers are always at your service—always ready to offer expert assistance, gained from their many years of experience. This is another reason why it pays to do business with the leader.

Specify R-B punches and related tools for all your metal-piercing needs. R-B stocks more than 10,000 different punches, die buttons and retainers. Whatever your requirements, they are the strongest, most durable you can buy.



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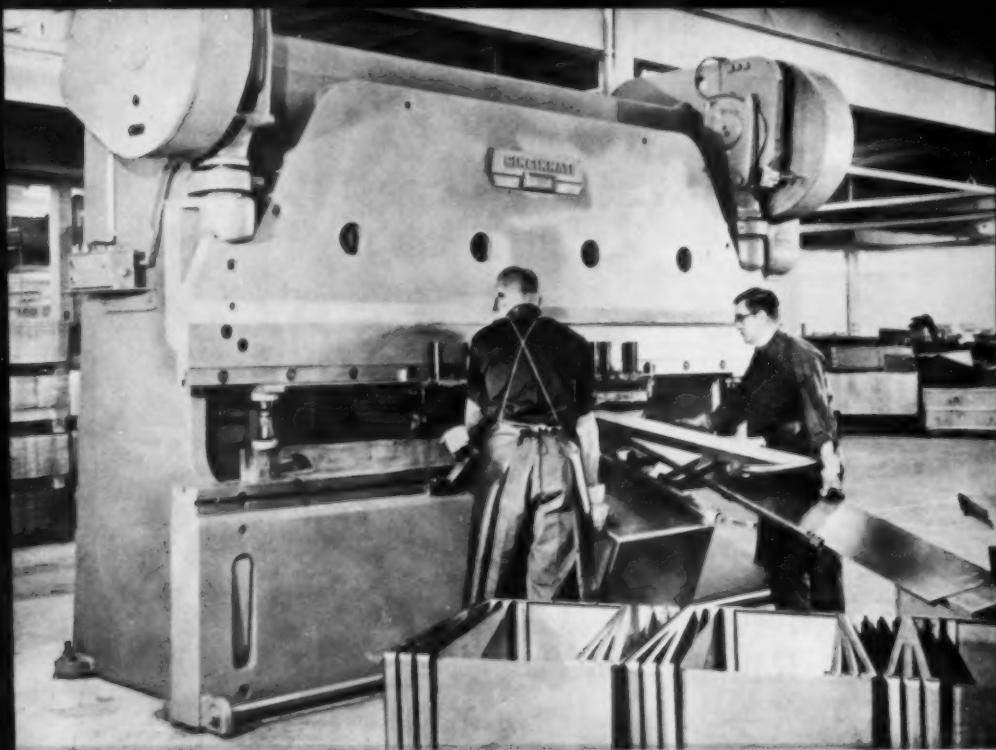


*Courtesy Steelcase, Inc., Grand Rapids, Michigan*

# Efficiency

## THESE CINCINNATI® PRESS BRAKES

"A million hits a year; downtime nil for 20 years." That's the story of this Cincinnati press brake at Steelcase, shown forming a  $\frac{1}{16}$ " offset on four sides of a desk top. The ruggedness of this veteran machine "permits the operator to perform high speed pedaling with excellent control." Proof, again, of the reliability built into every Cincinnati press brake.



# jumps 50%

## FORM PROFITS FOR STEELCASE, INC.

50% more efficient than previous method, this 150-ton Cincinnati forms four radius corners on pedestal bodies. "High degree of accuracy and convenient operation," according to Steelcase, help operators produce 80 pieces per hour. The machine operates more quietly and takes less floor space than their previous equipment.

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CLIP AND FILE

## END MILL TIPS YOU CAN USE

IMPROPER SPEEDS, FEEDS  
RESULT  
IN  
THIS...



Improper speeds or feeds as well as failure to use adequate cooling methods lead to rapid, excessive wear on end mills. If end mill users would observe good cutting tool practices on these problems they could cut their tool costs and obtain better overall performance. Follow chart below.

### SPEED AND FEED CHART (SFM)

Material	Speed
Aluminum and Magnesium	400-600
Brass	200-500
Iron - Cast and Malleable	90-100
Steel - Cast, Soft Alloy	70-80
Steel - Hard Alloy	30-50
Steel - Stainless	50-80

Feeds vary with diameter . . . from .0002" to .0005" small sizes to .003" up to larger sizes—per RPM.



### CUTTING FLUIDS

You will get a better finish to your work and far more mileage from End Mills if you achieve the best possible use of coolants. No brief statement can cover all situations, but best general advice is to use multiple streams—one on leading side of tool—one on back. Keep the flow heavy and steady.

### GOT A PROBLEM?

Arrange a consultation with a Chicago-Latrobe Service Engineer. His experience can lead to a quick solution of your problem. Also request comprehensive End Mill Speed and Feed Chart.

# Best tip of all...

ASK YOUR  
DISTRIBUTOR  
FOR ...



# Chicago-Latrobe END MILLS

DRILLS • REAMERS • END MILLS  
COUNTERSINKS • COUNTERBORES  
CARBIDE TOOLS • SPECIAL TOOLS and  
"LO-TORK" CHIP BREAKER DRILLS



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for CATALOG No. 60 Sixty-eight pages of illustrated  
listings and specifications—including prices.

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418 West Ontario Street

Chicago 10, Illinois

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MACHINE and TOOL BLUE BOOK



Teeth in ratchet head and socket openings are induction heated for hot forming without tears or ruptures. Over-heating of steel is avoided and decarburization is prevented. Unusual accuracy is attained and the grain structure of the metal remains unbroken.



Completely machined ratchet and socket blanks are heated and quenched in a series of salt baths to develop the proper relationship of toughness and hardness without decarburization or dimensional distortion.

# A Push Button World at WILLIAMS produces

## Detachable Socket Wrenches that have **RESERVE STRENGTH** for **THE TOUGHEST JOBS**

### B-52 and S-52 RATCHET FEATURES



### DETACHABLE SOCKET FEATURES



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The unique combination of the latest automated equipment and design "know-how" produces a complete line of rugged, detachable socket wrenches which "bear up" under every stress condition encountered. Improved grain structure and precisely controlled heat-treating build up an unusual resistance to metal fatigue. These reserves of strength are hidden but guaranteed qualities built into all Williams' wrenches.

MR. WRENCH SAYS: "Get the Facts...get **TOOLFAC**TS...new 24 page booklet on how to select, use and care for Quality Wrenches."

### J. H. WILLIAMS & CO.

Division of United Greenfield Corporation  
410 VULCAN STREET, BUFFALO 7, N.Y.

Mr. Wrench: Please send me your new

**TOOLFAC**TS Booklet  **ILLUSTRATED CATALOG** No. 204

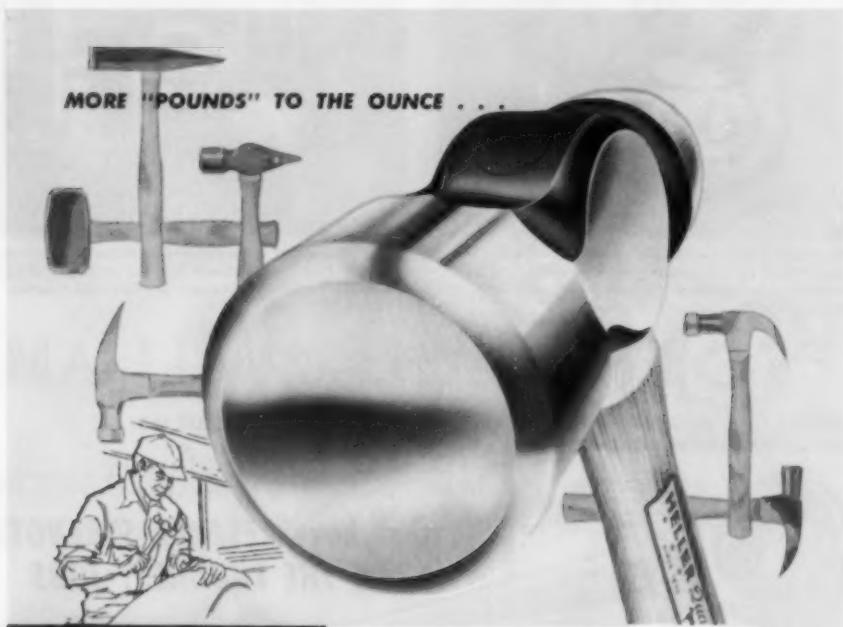
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FIRM \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

**WILLIAMS**



... when you standardize on

# Heller

SAFETY-PROVED  
Hammers  
with  
*Job-Tempered Heads*

BLOW FOR BLOW, THERE'S NO SAFER, STRONGER MACHINIST'S HAMMER THAN A HELLER . . . in head weights ranging from 2 ounces to 3 pounds.

**FIRST IN SAFETY!** Every head has a crowned face with a safety rolled edge for built-in protection to both the head and the work. Every hickory handle is shaped to give a non-slip grip. Every pein . . . ball, cross or straight . . . is precision ground to a uniform shape.

**FIRST IN STRENGTH!** Heller has combined the latest metallurgical developments with their unique tempering techniques to create "Job-Tempered" heads. For strenuous use, heads are forged from special analysis alloy steel. For routine work, heads are forged from high carbon tool steel.

**INSIST ON JOB-TEMPERED HAMMERS!** . . . identified by the hickory handle with the exclusive Heller Spot-Burned finish.

CATALOG NO. 7-54 describes the complete Heller line of hammers and hatchets. Get it from your nearby Heller Distributor.



America's Oldest File Manufacturer  
**NEWCOMERSTOWN, OHIO**  
Subsidiary of Simonds Saw and Steel Co.

17-9-2

**HELLER TOOL CO.**

Branch Offices and Warehouses: Boston • Newark, N. J. • Detroit • Chicago • Shreveport • Los Angeles • San Francisco • Portland, Oregon

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# SPIROPOINT\*

*makes twist drills produce  
at Breeze Corporations, Inc.*

*says Works Manager Harold Schwartz*

**"...50% greater drill life"**

**"...up to 40% saving in drilling time"**

**"...centering operations eliminated completely—  
reaming unnecessary on many jobs"**

**"...70% reduction in workpiece distortion"**

Breeze Corporations, Inc. of Union, New Jersey, executes complete design and production of precision electrical, electro-mechanical, and hydro-mechanical components and systems. Drilling costs have been cut at Breeze because, with spiral points, all holes are "right on center, round, smooth, and right to size—at both ends!", Mr. Schwartz stated.



Cincinnati SPIROPOINT® Drill Sharpener applies the new spiral point geometry to standard twist drills in a matter of seconds.

Works Manager Schwartz holds "Guillotine" safety device used on helicopter hoists. Production drilled holes  $1\frac{1}{2}$ " deep are held to .001" tolerance on straightness.

Aluminum slip ring housing 3' in diameter has 576 holes. The  $\frac{1}{4}$ " holes are drilled through  $\frac{3}{4}$ " metal with spiral point drills in one-third the time normally required. Change in shape of the relatively fragile casting was negligible.



$\frac{1}{4}$ " drilling of this missile control launcher part is held to .001" tolerances on hole location and diameter—center drilling and reaming operations eliminated.



**CINCINNATI LATHE AND TOOL CO.**

Cincinnati, Ohio

HYDRA-SHIFT Lathes • CINCINNATI Drilling Machines • SPIROPOINT Drill Sharpeners

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now you can check & record  
fine-pitch gear accuracy



at 1600 magnifications

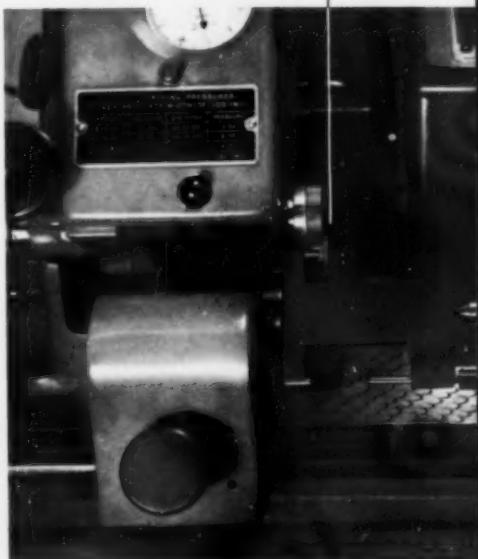
on the No. 4 Fellows Red Liner

Now, the No. 4 Red Liner makes "composite" checks on the finest instrument gears with unbelievable accuracy and sensitivity. 1600 to 1 magnifications are obtained with the electrical recording system which gives a written, unbiased record for instant reading or for proof-of-accuracy files.

One report states - "11 teeth, 200 D. P. pinion backed up to a 100 tooth gear on a cluster, checked easily on the No. 4 Red Liner."

The job shown is 96 pitch with 22 teeth on the small gear and 80 teeth on the larger gear. The pinion shaft rides in vees in a turret-type fixture.

Fellows inspection units cover a range from the tiniest instrument gear up to some that are 24 inches in diameter.



THE FELLOWS GEAR SHAPER COMPANY  
78 River Street, Springfield, Vermont

Branch Offices:  
1048 North Woodward Ave., Royal Oak, Mich.  
150 West Pleasant Ave., Maywood, N. J.  
5835 West North Avenue, Chicago 39  
6214 West Manchester Ave., Los Angeles 45



Investigate the full line of Fellows inspection equipment



No. 4 Fine-Pitch  
Red Liner



No. 8M  
Red Liner



No. 20M  
Red Liner



No. 12H Lead  
Measuring



No. 12M  
Involute  
Measuring

THE  
PRECISION  
LINE

**Fellows** Gear Production Equipment

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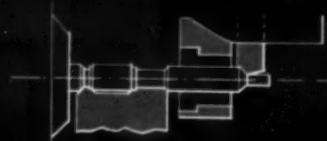
October, 1960

41

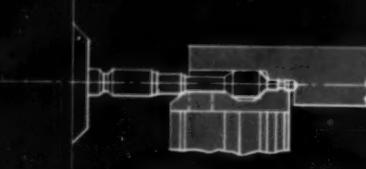
Acme-Gridley Speed & Accuracy...

# SLASHES TOTAL MACHINE TIME 76.4%

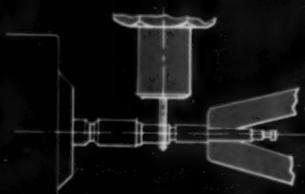
for E. F. Johnson Company



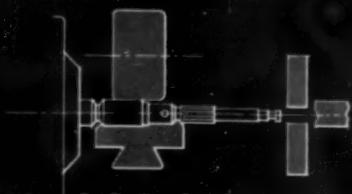
6th Position: Turn .075 dia. - form .165 and .198 dias. - mark for cut-off - support.



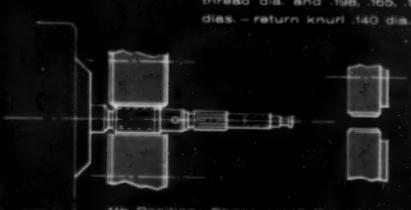
1st Position: Support - form knurl dia. .065 and .075 dias.



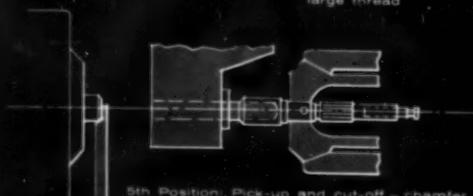
2nd Position: Stop spindle - cross drill - hollow-mill small thread dia.



3rd Position: Start Spindle - shave large thread dia. and .198, .165, .140 and .130 dias. - return knurl .140 dia. face end.



4th Position: Chase small thread - roll large thread

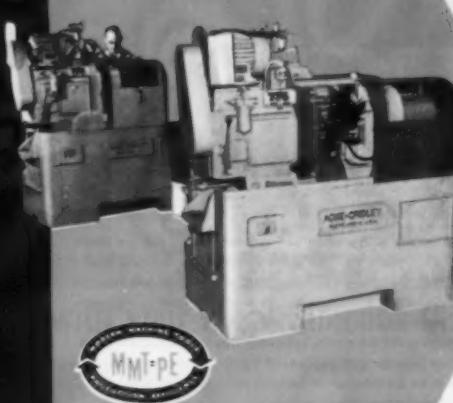


5th Position: Pick-up and cut-off - chamfer front end of next piece - back drill - eject - chamfer front end

Total Machine Time  
- 5 Seconds

... also . . . cost-per-piece is substantially reduced . . . part uniformity and quality definitely improved . . . scrappage all but eliminated.

This is the *record* of two Acme-Gridley  $\frac{7}{16}$ " RA-6 Spindle Bar Automatics installed at the E. F. Johnson Company, Waseca, Minnesota. Producing some 15 intricate parts, like those shown, the rugged and versatile Acme-Gridleys continually meet the rigid specs of this well-known manufacturer; help make high quality products such as the Viking Messenger Citizen's Band two-way radio available at prices that fit the public's pocketbook.



Viking Messenger Citizen's Band  
two-way radio

Parts Shown  
Actual Size

Tangible production savings, like those realized by E. F. Johnson, are assured with Acme-Gridleys. In your plant, the  $\frac{7}{16}$ " RA-6, or any of the world's most complete line of multiple-spindle automatic bar and chucking machines will show you a new dimension in mass production efficiency.



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Acme**

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177 E. 131st Street  
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 8, Ill.; Detroit 27, Mich.

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**DEPENDABLE... predictable response to  
heat treatment every time**



Send for Bulletin 102—  
"Helpful Heat-Treating  
Hints."

The full uniformity within each bar of Desegregated FM die steel and the consistent uniformity from lot to lot simplifies the heat treatment of your die components. Predictable hardnesses are readily attainable... distortion and size change are minimized... danger of cracking is lessened!

In free machining FM die steels, full uniformity is achieved through Latrobe's unique Desegregated process of manufacture. This process guarantees an even distribution of carbide particles, free machining alloy sulphides and other alloying elements... factors leading to improved machinability, greater toughness and improved wear resistance in addition to the optimum heat-treating characteristics.

Latrobe's 12% chromium FM die steels are available through district steel service centers near you. Grades include: Olympic FM (Type D-2) for long-run applications; GSN FM (Type D-3) non-deforming die steel; Cobalt Chrome FM (Type D-5) for extra resistance to galling and pickup.

Call your Latrobe representative today!

Manufactured  
by skilled  
American  
labor



**LATROBE STEEL COMPANY**  
LATROBE, PENNSYLVANIA

BRANCH OFFICES and STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO  
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Simonds offers you  
3 TYPES of Metal Cutting  
Band Saws:



**SUPER High Speed Steel** — an entirely new concept in band saws; this super blade will give up to 3 times better performance than any other high speed steel blade.



**Standard High Speed Steel** — a tool of highest quality, designed for maximum speed and longer life than conventional metal cutting band saw blades.



**Hard Edge Carbon Steel** — a top quality blade well known for its versatility. Furnished in all standard widths and tooth styles for contour or cut-off work.



**Local Skill.** Your local Simonds Distributor is ready and able to help you solve your cutting problems. He's always "on call" for emergency service or engineering help.

## SIMONDS PERFECTIONERS EVERY ORDER with your Local Simonds Distributor's "Triple-S-Service"

(LOCAL SKILL — LOCAL STOCKS — LOCAL SPEED)



Local Stocks of your Simonds Distributor mean less money you have to tie up in inventory, and big savings in stockroom space.



Local Speed of your Simonds Distributor means fast delivery. Greater convenience, too, with one order, one invoice, one check covering many different items.

Back of the "controlled conditions" quality of every Simonds cutting tool is the "Triple-S-Service" of your local Simonds Distributor. He not only stocks and services your account with local speed, but provides a local source of technical skill and know-how.

As your local Simonds Distributor, he is thoroughly schooled in the proper application and use of Simonds cutting tools. And can help you *perfectioner* your toughest wood or metal cutting jobs.

For the best combination of quality cutting tools and on-the-spot service that saves you time, work and money — use the "Triple-S-Service" of your local Simonds Distributor.

Factory Branches in Boston, Chicago,  
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Portland, Ore. Service Centers in  
Montreal, Que. • Simonds Divisions:  
Simonds Steel Mill, Lockport, New York;  
Simonds Abrasive Co., Newmarket, Ohio;  
Simonds Abrasive Co., Philadelphia, Pa.  
and Alvinia, Que., Canada.

**SIMONDS**  
SAW AND STEEL CO.

FITCHBURG, MASSACHUSETTS



Get your local Simonds Distributor

— For Local Stocks — Local Speed — Local Skill

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For tips on finding the Great Horned Owl...  
call an **ORNITHOLOGIST**

*(specialist on birds)*



MACHINE and TOOL BLUE BOOK



for tips on welding stop-and-go jobs...  
call in **LINCOLN**

*(specialists in arc welding)*

**A**KANSAS MANUFACTURER OF MOBILE HOMES doubled the welding speed on his undercarriages by simply changing electrodes—and in addition, saved over \$8000 in the first year.

Manufacturing cost on undercarriage fabrication was prohibitive. Thirteen gauge cross members were welded to twelve gauge channels by welds made in both vertical and flat positions. These short welds on steel having some scale and oil slowed down production.

Finally they called in their LINCOLN Field Engineer. Painstaking tests, made by the LINCOLN man with the welding foreman and plant superintendent, proved LINCOLN's Fleetweld 37 electrodes far better for this application.

RESULTS: lower costs . . . welding speed doubled . . . cleaning time cut in half.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

THE LINCOLN ELECTRIC COMPANY  
Dept. 2120 • Cleveland 17, Ohio



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# STEELWELD SHEAR

## Operates 16 Hours a Day

Cuts Components for  
Prefabricated Buildings



Cutting and slitting operations normally keep this Steelweld Shear busy 16 hours a day. It is equipped with Steelweld's popular Micro-Set Knife Adjustment. This permits adjusting the knife clearance to suit the thickness of metal being cut in the matter of seconds. Thus, the finest cuts are assured for every shearing job.

A recent Pascoe Building

RAPIDLY forging ahead in the prefabricated steel building field, Pascoe Steel Corporation, Pomona, California, has found its Steelweld Shear to be an extremely important factor in maintaining a steady rate of production. A large amount of shearing is required to fabricate several hundred tons of steel per month.

The Shear is normally operated 16 hours a day. It is used for cutting web plates for building columns, rafters and many other building components. About 20 hours a week it is used for slitting. The machine has functioned with very

little maintenance. In nearly three years of service, the clutch has never required adjustment.

For the very latest in shears and brakes, mechanically or hydraulically operated, be sure to see what Steelweld has to offer.

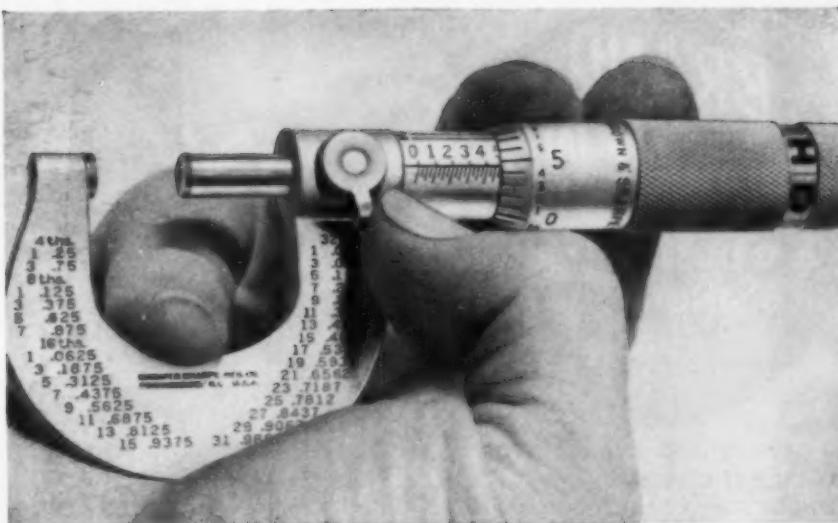
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**STEELWELD**  
PIVOTED  
BLADE  
SHEARS

Steelweld Machinery includes: Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO., 5259 E. 282 ST. • WICKLIFFE, OHIO

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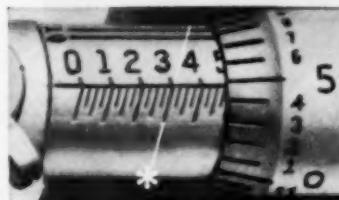


## New B & S mike cuts reading mistakes with graduations that can't hide!

This new Brown & Sharpe micrometer prevents 25-thousandth mistakes with graduations that are *slanted*, to stay in view for a full revolution. They can't hide at the wrong time!

It's the only mike that shows, at a glance, "where you're going and where you've been."

Ask your Brown & Sharpe dealer for the new B&S No. 1011 Micrometer that protects you against .025" mistakes. No charge for personalized initials. Brown & Sharpe Mfg. Co., Providence 1, R. I.



New B&S No. 1011 Micrometer has slanting barrel graduations — thimble that converts to "friction" or "fixed" type — handy thumb-operated wrap-around lock — satin finish, — easy zero setting and wear adjustment — carbide faces — dependable B&S precision. Range: 0-1", in 10-thousandths.

**Brown & Sharpe**  PRECISION CENTER

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# BRAND NEW!

**SANFORD MG GRINDER  
and DUST COLLECTOR  
in a SINGLE COMPACT  
UNIT**

**MG GRINDER ALSO AVAILABLE FOR  
DRY OR WET GRINDING  
WITHOUT DUST COLLECTOR**

The most widely used precision machine for unit grinding. Famous for its unsurpassed workmanship, quality and vibration-less operation. The MG is the grinder that's been "copied" but never equaled.

#### PARTIAL SPECIFICATIONS

**GRINDER:** CAPACITY — 8" x 12" x 12", TABLE TRAVEL — 13", TRAVERSE 8 1/2", VERTICAL CLEARANCE — 12" under 7" wheel. STAND-ARD GRINDING WHEEL — 7" x 1/2" x 1 1/4" hole. SPINDLE SPEED — 3000 RPM. MOTOR — 1/2 HP, single or 3 phase TEBB dynamically balanced.

**FLOOR SPACE** — 45" x 38", 62" high on floor stand. NET WEIGHT — 600 lbs.

**DUST COLLECTOR:** BUILT INTO GRINDER FLOOR STAND. EXHAUST CAPACITY — 650 CFM. MOTOR — 1/2 HP, 3450 RPM, single or 3 phase. NET WEIGHT — 140 lbs.



**A  
COMPLETE  
DUST COLLECTOR  
INCORPORATED INTO  
GRINDER STAND.**

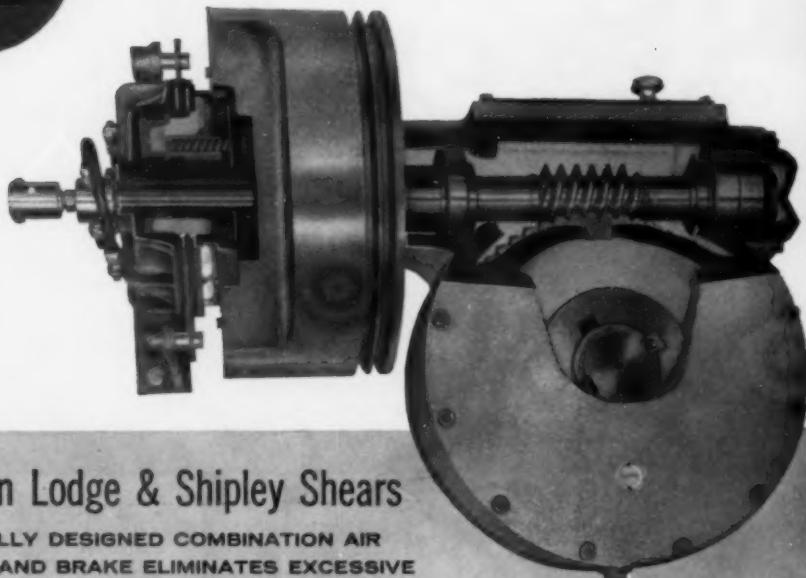
- Exclusive design exhaust hood catches all sparks.
- Can be wired to grinder starter.
- Uses standard size filters—renewable or disposable type, or a combination of both.
- No outside exhaust needed.
- Saves floor space.
- Full size rear door gives access for cleanout.

**SANFORD** MANUFACTURING CORP.  
1026 Commerce Ave., Union, N. J.

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# EXTRAS

on the machine... not on the invoice!



## Only on Lodge & Shipley Shears

...SPECIALY DESIGNED COMBINATION AIR  
CLUTCH AND BRAKE ELIMINATES EXCESSIVE  
MAINTENANCE COMMON ON HEAVY DUTY PLATE SHEARS

The "standard extras" you find on Lodge & Shipley Shears, although not reflected in the price, are important in time-saving, effortless operation, accuracy and low-cost service.

**THE COMBINATION AIR CLUTCH AND BRAKE**, for example . . . its single unit design positively eliminates overlap between clutch and brake. Disc-type construction is self-adjusting for fast, smooth starting and safe, positive stopping. The clutch provides automatic overload safety; the brake applies automatically in the event of electrical or air supply failure.

**NO OTHER SHEAR, EVEN AT EXTRA COST**, can offer the exclusive combination of features found, for instance, on the  $\frac{3}{4}$ " Lodge & Shipley Shear:

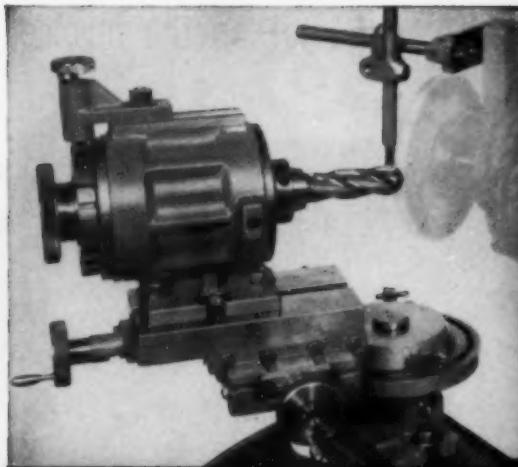
- 2-stage Hydraulic Holdown System
- Remote-operating Foot Control • Ball Transfer Table
- Motorized Front-Operated Back Gauge
- One-piece Shaft with Integral Eccentrics
- Blade Clearance Indicators • Air Counterbalances
- Air-cushioned Back Gauge • Blade Changing Jigs
- Fast, One-man Upper Blade Adjustment
- Independent Holdown Fingers • Quad-life Worm Gear

Capacities to  $\frac{1}{2}$ " x 12"

Find out how much more you get . . . **WITHOUT EXTRA COST** . . . on a Lodge & Shipley Shear. For details, see Sweet's Machine Tool File or request Bulletin No. PS-15 from: **The Lodge & Shipley Co., 3074 Colerain Ave., Cincinnati 25, Ohio.**

# Lodge & Shipley

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Precision ball bearing workhead 6B mounted on compound Slide for setting cutter to correct position when grinding end cutting flutes and radii. Other type workheads available.

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes.

UNIT 1A. Universal Cutter Grinding Fixture fits any universal tool or surface grinder.



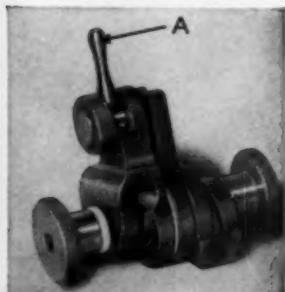
UNIT 4A. Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.



THE  
UNIVERSAL  
RADIAL  
CUTTER  
GRINDING  
FIXTURE

NEW FINE-ADJUSTMENT  
SLIDING SWIVEL GIVES  
SMOOTH, PRECISE INDICA-  
TOR SETTING.

Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A"



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SLIDING SWIVEL FOLDER

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# King

# BERKROY

## PRODUCTION TOOLS

Designed for Industry

...to Cut

Manufacturing Costs



**Sheet Metal  
SHOP-ON-A-BENCH**

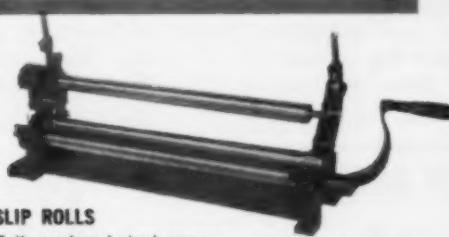
- Nibbler-Slitter • 12" Brake • 12" Slip Roll
- Hand Punch • Shear & Clamping Head

(Tools sold separately, also.)



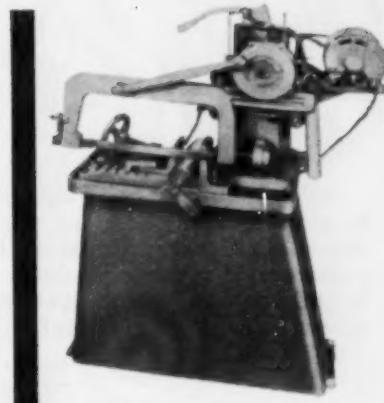
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Accurate, Versatile. 24" - 30" - 36"



**SLIP ROLLS**

Fully enclosed steel gears.  
18" - 24" - 30" - 36"



**POWER HACKSAW**

Two sizes — 4x4, or 6x6 inch  
stock capacity.

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**READY SHIP — New Berkroy Bench Shear — 15 lbs. — 12" 24" 36"**



Since 1918

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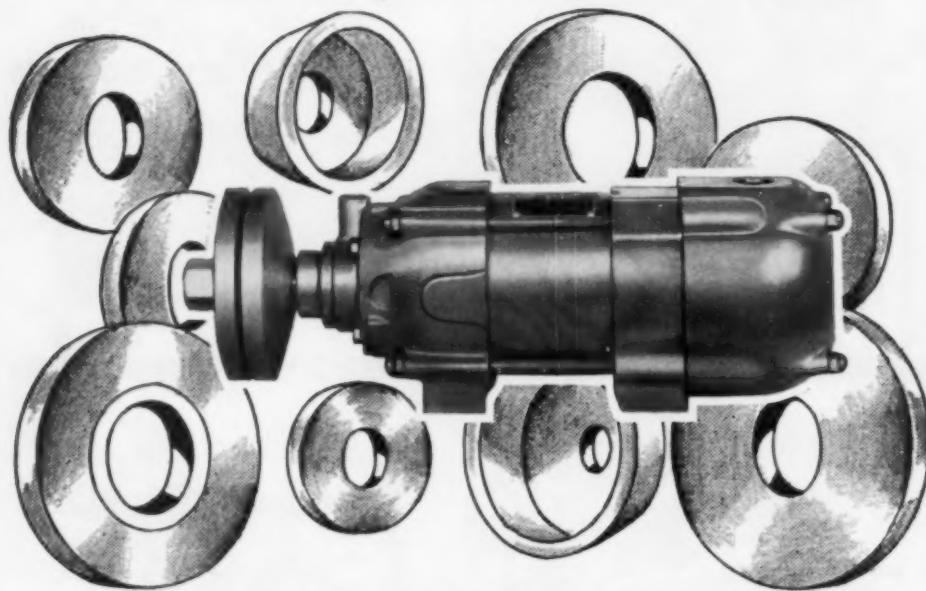
1171 East 32nd Street, Los Angeles 11, California

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For complete information, write:*

*Serving the Industry Since 1852*



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Precision built and "tape insulated," WOODS motors are available in a wide variety of types and range from one to one hundred horsepower. Extremely adaptable for use requiring precision balance, a minimum of space and delivering the maximum of power. Why not investigate the advantages of these time-and-money saving motor arbors for your plant today?

Send for descriptive material

**MOTOR DIVISION**

**S. A. Woods Machine Co.**  
27<sup>o</sup> DAMRELL STREET  
**BOSTON 27, MASS.**

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# A million tons of cutting experience build performance into LADISH Saw Blades

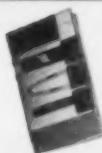
When you buy Ladish blades... you get the added advantage of experience gained in cutting over a million tons of a broad range of metals... experience that means you will get sustained cutting efficiency, long, dependable blade life, and more cuts per dollar.

On your next requirement... buy Ladish blades... the complete, quality line marketed by one of the largest users of saw blades.

## LADISH CO.

Cudahy (Milwaukee Suburb), Wis.

PROVE TO YOURSELF THE ADDED LIFE  
AND CUTTING EFFICIENCY  
OF LADISH BLADES



### HANDY POCKET SIZE CUTTING GUIDE AND CATALOG

Contains answers to cutting problems. Provides quick reference to saw blade specifications. Write for Bulletin 578.



### LADISH CO., Cudahy, Wisconsin

Please send me without cost or obligation the Ladish Handy Pocket Size Cutting Guide and Catalog.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

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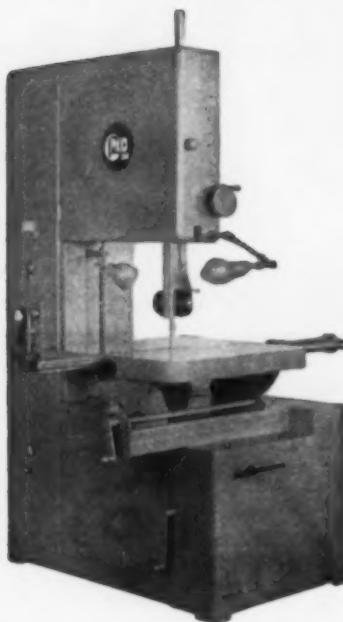
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SPELLS THE DIFFERENCE IN  
BAND SAW MACHINES

The new GROB 24" universal band saw  
has all the famous GROB features:

Quality • Efficiency • Durability • Strength  
Utility • Low Maintenance • Reasonable Cost



- Speeds infinite from 35-12000 FPM covers both cold and hot sawing
- Variable drive 3-speed transmission with precision rolled gears and splines transmits 15 HP
- Hydraulic table feed

See the difference demonstrated in our dealers' showrooms

or

Write GROB INC. for complete specifications

**GROB** also manufactures a complete line of:



**BUTT WELDERS  
FILING MACHINES  
GEAR ROLLING MACHINES**

**GRAFTON, WISCONSIN**

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DO YOUR OPERATIONS DEMAND ACCURATE CENTERS?



BEFORE LAPPING

- Out of line
- Out of round
- Incorrect angle
- Rough or torn



AFTER LAPPING

- Perfect alignment
- True roundness
- Precise angle
- Mirror-smooth

Machinery Division

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CORPORATION  
DETROIT 32, MICHIGAN

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS  
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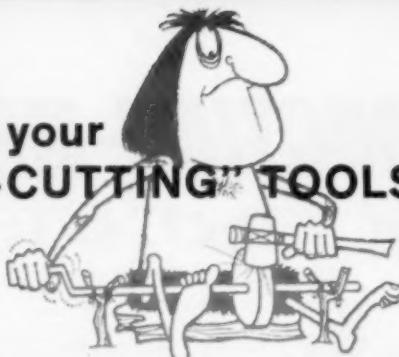
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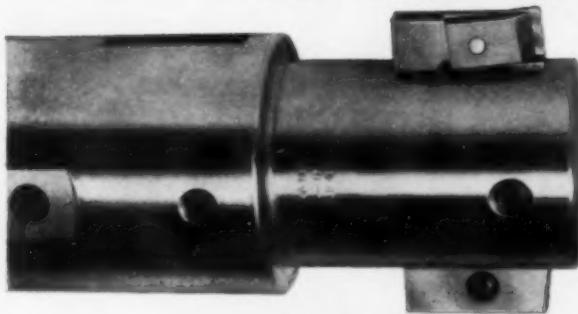
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Use the new indexable carbide inserts in

**DOUBLE-CUTTER BORING BLOCKS**  
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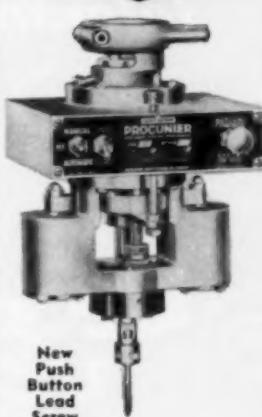


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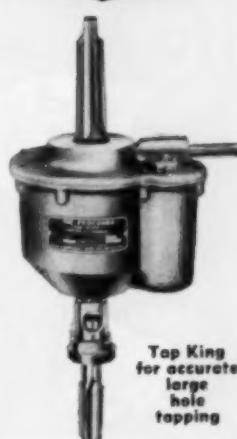
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"why not

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**tolerance!"\***



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Can you put your finger on  
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approximately \$3.50 each

**TOTAL**  
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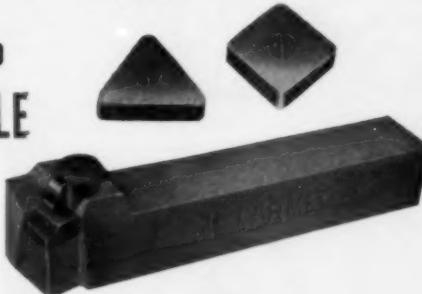
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with 800 cutting edges at  
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**CARMET**  
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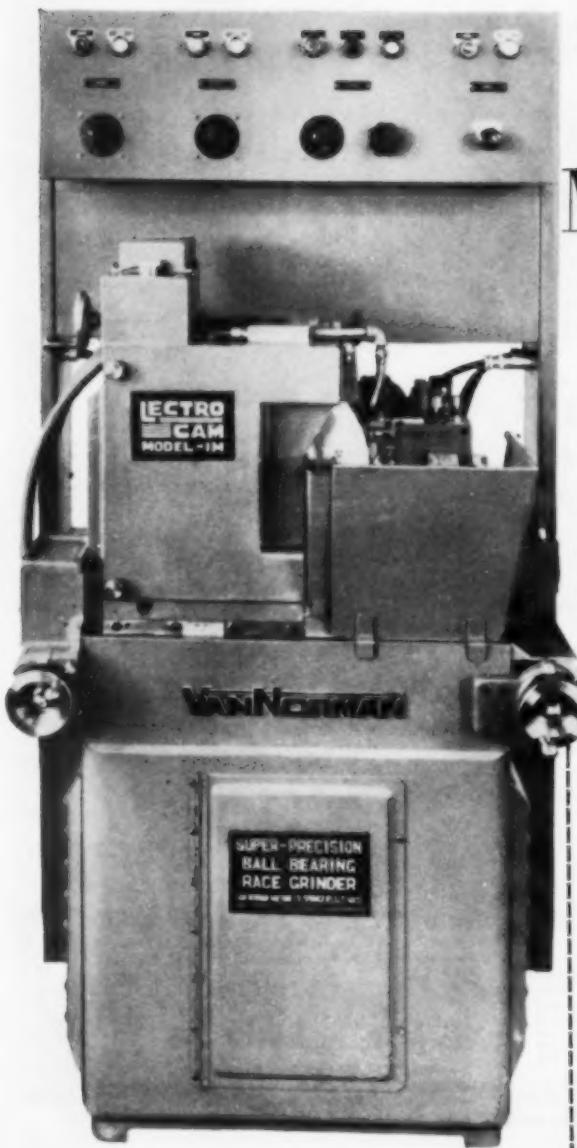
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LONGER cut-off blade life  
SMOOTHER cut-off surfaces**

**WIDEST RANGE OF BLADE MATERIALS**

1. Empire cut-off blades are available in four grades of H.S. Steel (high-cobalt, high-vanadium). Range covers most any requirement for H.S. Steel tooling.
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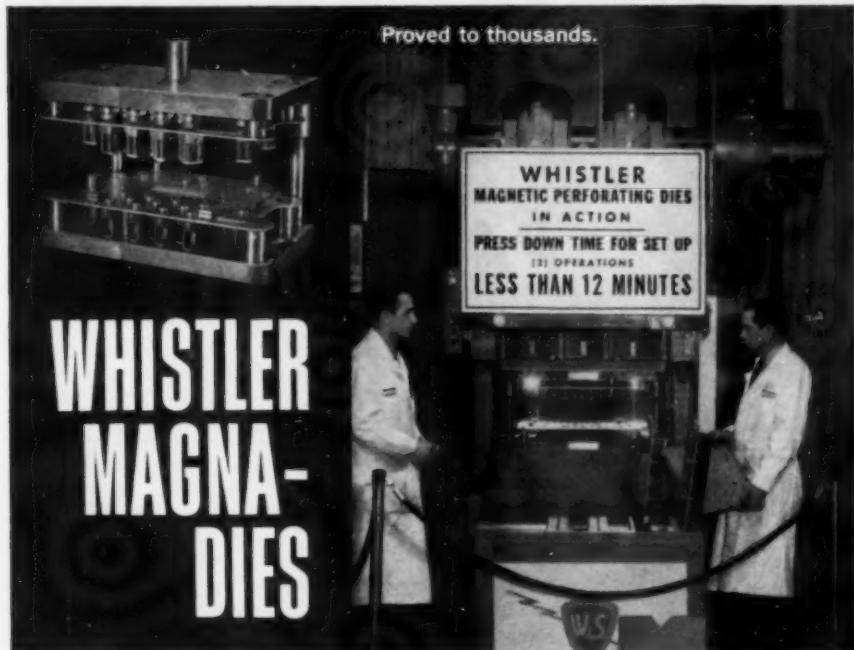
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- **REDUCE DIE COSTS:** In one plant, over 1500 operations (for parts up to 3' x 5') have been toolied up at an average cost of \$200 each.
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October, 1960

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with

## SYNTRON

Transfer & Storage

# PARTS FEEDERS

—fully automate the transfer and storage of small parts from one operation to another—reduce manual handling of parts, increase production.

SYNTRON Transfer & Storage Parts Feeders are designed to automatically receive parts at one level from one operation, store and discharge oriented parts at another level at controlled rates to another operation.

SYNTRON Transfer & Storage Parts Feeders are custom built for your operation. Their electromagnetic drive assures dependability of operation—eliminates costly maintenance.

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MACHINE and TOOL BLUE BOOK

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FOR JUST **\$63**



**Check  
VersaTAPPER  
Features:—**

- Capacity 0-1/2"
- Comes complete with tap chuck
- Ball bearing spindle
- Runs in oil
- Fits any drill press
- Fully guaranteed
- Installs in seconds

# Supreme VersaTAPPER

## DRILL PRESS TAPPING ATTACHMENT

The new Supreme VersaTAPPER gives tremendous tapping versatility — at a price that is no higher than some hand tapping devices. VersaTAPPER's capacity range is from 0 to 1/2". VersaTAPPER fits any drill press. It can be installed or removed in seconds. Why not circle

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From the makers of SUPREME BRAND CHUCKS

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DIV. OF A-S-R PRODUCTS CORPORATION

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## TO CUT OFF AND FORM TUBING AND BAR STOCK IN A SINGLE OPERATION

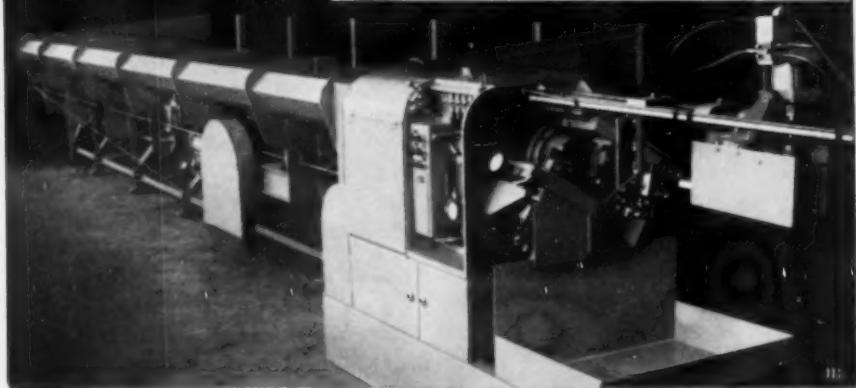
Here is a combination that feeds tubing and bar stock — automatically — to a fast, automatic cutting-off machine. Best of all, the pieces being cut off can be formed, grooved, flanged or chamfered at the same time.

There are models that handle tubing, pipe and bar stock from  $\frac{1}{8}$ " diameter up to solid bar stock of 3" OD and tubing up to 8" OD.

Why not investigate?

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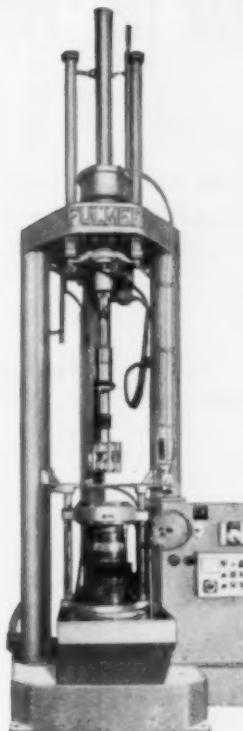
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# CUTTING TOOLS

**ABSOLUTE  
ACCURACY  
ON PRECISION  
JOBS**

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**JOB:** 10 cutting operations with one tool: 5 boring,  
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**TOOL:** Eclipse multi-diameter; replacing normal  
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**RESULT:** Absolute accuracy and concentricity.

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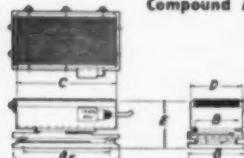
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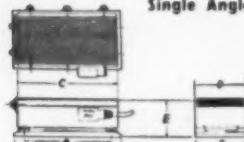


**Compound Angle Sine Chuck**



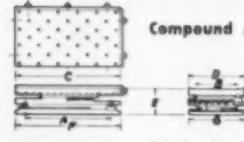
MODEL	(SINE) A	(SINE) B	C	D	E	F	G	PRICE
ELECTRO-MAGNETIC								
DA-5	5.000	5.000	6 1/2	6	5 1/2	7 1/2	6 1/2	\$ 445.00
DA-10	10.000	5.000	11 1/2	6	5 1/2	12 1/2	6 1/2	590.00
DA-1010	10.000	10.000	11 1/2	10	5 1/2	12 1/2	10 1/2	1,180.00
DA-20	20.000	5.000	21 1/2	6	5 1/2	22 1/2	6 1/2	1,400.00
PERMANENT MAGNET								
DP-5	5.000	5.000	6	6	5 1/2	7 1/2	6 1/2	445.00
DP-10	10.000	5.000	12	6	5 1/2	12 1/2	6 1/2	590.00

**Single Angle Sine Chuck**



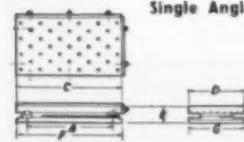
MODEL	(SINE) A	C	D	E	F	G	PRICE
ELECTRO-MAGNETIC							
SA-5	5.000	6 1/2	6	4 1/2	7 1/2	6 1/2	\$ 310.00
SA-10	10.000	11 1/2	6	4 1/2	12 1/2	6 1/2	390.00
SA-1010	10.000	11 1/2	10	4 1/2	12 1/2	10 1/2	775.00
SA-20	20.000	21 1/2	6	4 1/2	22 1/2	6 1/2	950.00
PERMANENT MAGNET							
SP-5	5.000	6	6	3 1/2	7 1/2	6 1/2	310.00
SP-10	10.000	12	6	3 1/2	12 1/2	6 1/2	390.00

**Compound Angle Sine Plate**



MODEL	(SINE) A	(SINE) B	C	D	E	F	G	PRICE
DA-5P	5.000	5.000	6 1/2	6 1/2	3 1/2	7 1/2	6 1/2	\$ 430.00
DA-10P	10.000	5.000	11 1/2	6 1/2	3 1/2	12 1/2	6 1/2	565.00
DA-1010P	10.000	10.000	11 1/2	11	3 1/2	12 1/2	11	1,050.00
DA-20P	20.000	5.000	21 1/2	6 1/2	3 1/2	22 1/2	10 1/2	1,350.00

**Single Angle Sine Plate**



MODEL	(SINE) A	C	D	E	F	G	PRICE
SA-5P	5.000	6 1/2	6 1/2	2 1/2	7 1/2	6 1/2	\$ 280.00
SA-10P	10.000	11 1/2	6 1/2	2 1/2	7 1/2	6 1/2	380.00
SA-1010P	10.000	11 1/2	11	2 1/2	12 1/2	11	750.00
SA-20P	20.000	21 1/2	6 1/2	2 1/2	22 1/2	6 1/2	920.00

Order now for prompt delivery

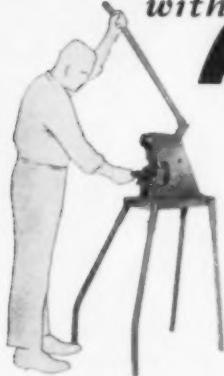
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BIG RAPIDS, MICHIGAN, U.S.A.

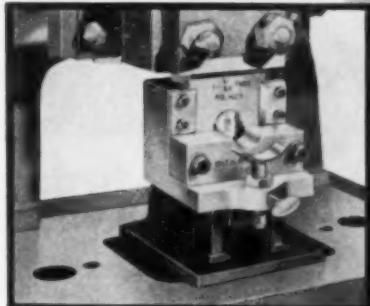
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PIPE ENDS *per minute*  
with **ARC-FIT®**



Mounted in hand  
press with port-  
able stand.



Complete unit with adapter  
mounted in punch press.

**ARC-FIT notching makes perfect  
joints for welding or brazing.**

The Arc-Fit cuts clean contours for "T" joints in seconds . . . without deformation . . . no finishing is required. Mounted in hand or power press it readily notches 12 pipe ends per minute . . . 750 per hour.

A standard Arc-Fit with easily interchangeable dies (one for each contour) notches pipe ranging up to 2" O.D.; or tubing up to 2 $\frac{3}{8}$ " O.D. Special Arc-Fits are available for larger sizes, angles other than 90°, slotting, notching square pipe and for angle iron or flat stock.

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October, 1960

Pipe, tubing and  
shapes notched  
with Arc-Fit units.

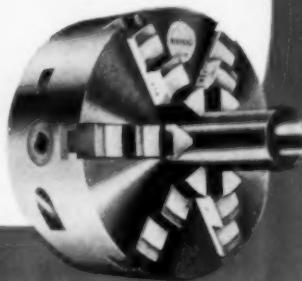
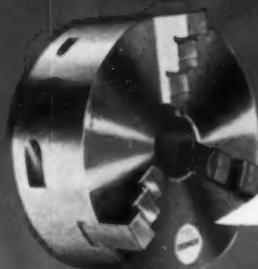


.0002" TIR



MEANS UNMATCHED PRECISION

## BURNERD GRIPTRU CHUCKS



Concentricity within .0002" TIR—on one piece or thousands—is the accuracy you can expect and get with Burnerd GRIPTRU chucks.

GRIPTRU's micro-adjusting mechanism eliminates the need for expensive collets, fixtures . . . saves time, speeds output . . . improves the accuracy of any machine tool, new or old. Perfect for tool room or production departments.

And GRIPTRU chucks are built to retain their greater accuracy under the toughest working conditions—Burnerd

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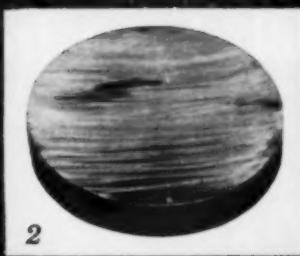
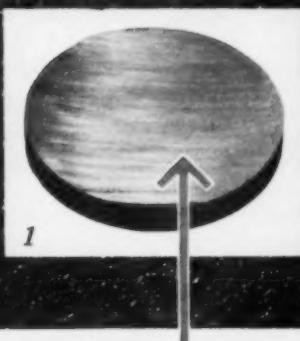
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ABRASIVE CUTTING KNOW-HOW

Close-up view of resinoid wheel shows rough texture that provides cooler, cleaner cutting



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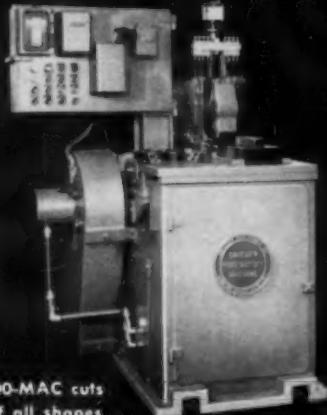
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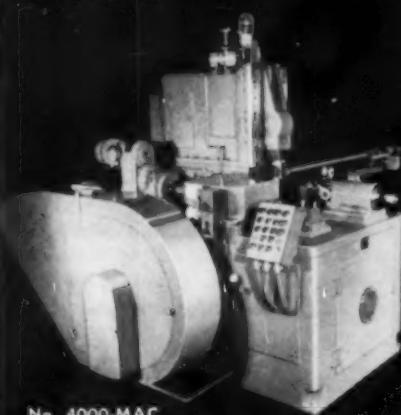
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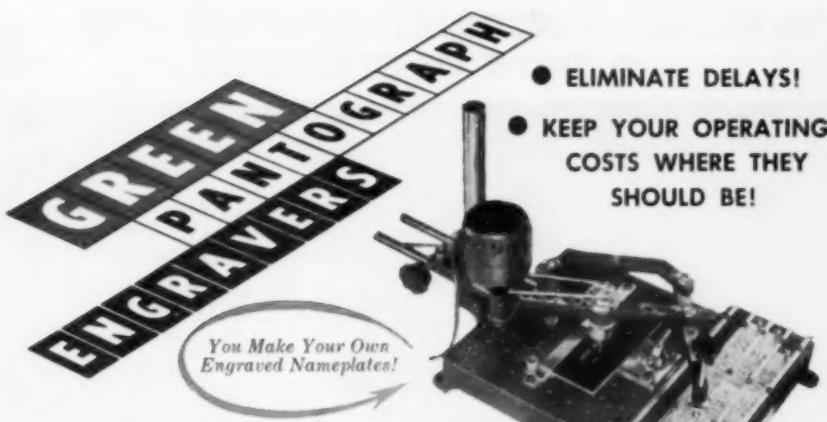
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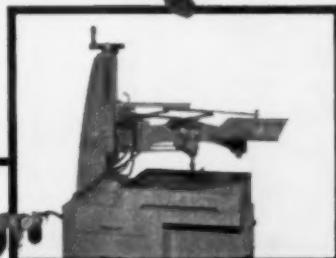


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MACHINE and TOOL BLUE BOOK

# features in this issue

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**WHEN—AND HOW MUCH—SHOULD YOU INVEST IN TOOLING?**

Harry Conn reviews important aspects of industrial economics with an eye on the fact that often tools used on a machine cost more than does the machine itself. When considering and planning a tooling program, these hints will help you to compute the economic justification for the tooling. .... **Page 101**

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**WHY PUT OFF PRACTICAL CONTROL OF PRODUCTION?**

Management Consultant Richard Landon's experience will prove valuable to those whose production control is carried out on an expediting basis, a situation prevalent in many job or short-run shops. Landon reviews the typical growth pattern of a company and shows where confusion can develop and what can be done to organize a smooth running production control system **Page 114**

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**VERSATILITY AND EFFICIENCY MAKE BAND SAWS A PROFITABLE TOOL**

Engineering Editor Darrell Ward continues his interesting series on sawing. In this part he reviews band sawing as a high-production, efficient and precise method of cutting stock. He also describes many of the differences among the three types of saw blades: hand, power, and band ..... **Page 126**

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**WHICH RATE IS RIGHT WHEN PRICING?**

\$6.00—\$7.00—\$8.00 Per Hour? asks Paul Prikos in his column **THE PRACTICAL DIE-MAKER**. An explanation, using a standard income and expense sheet, of how proper hourly rates or prices can be established. By knowing your costs, you will be quoting the right price. .... **Page 95**

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**WHEN CONSIDERING MACHINABILITY RATINGS . . . WHAT IS A REALISTIC STARTING POINT?**

Machinability ratings do have an important place in the metal working field. If properly applied to suit the conditions peculiar to an individual shop, they can be invaluable. Here are some suggestions from an expert, John A. Hedrick, which can help you better utilize your machines in your plant. .... **Page 91**

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**DON'T KEEP THE PROCESS ENGINEERS IN THE DARK ON MACHINE DEVELOPMENTS**

Too often the Process Engineer does not even know his company's pending decision to purchase new equipment. How can he be expected to do his job efficiently under such a handicap? Here is an example of how one company coordinates its activities to keep design and production in step with one another ..... **Page 87**

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# seen and heard in industry

2



By **Bill Schleicher**

Vice President and Editorial Director  
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## ✓ *The vital 10 per cent*

## ✓ *No longer can we rely on high tariffs*

■ Says an executive of a metal company, ". . . the population growth of our country is such that a company has to do 10% better than last year just to stand still."

What are the implications behind this statement? If a company proudly announces that its business volume is 5% ahead of last year, it is actually down 5% from what it ought to be. No cause for cheers here.

Should a business feel complacent, thinking its volume is the same as last year, it will be horrified to learn (and certainly will not believe) that it has lost 10% of its business to someone else.

Pity the poor organization which is down 5% or 10% from last year; it's whirling downhill at the rate of 15% or 20% and will land with a nasty 'kerplunk' in the red ink. For no matter how much business is lost or gained, no matter what sales volumes are or what production output is . . . costs keep going up. And if some doubters don't believe this executive let them bear in mind that costs certainly have gone up 10% and are continuing to rise. So, just to keep even with costs, business must be 10% ahead of last year.

The reasoning behind the original statement is sound.

With a growing population the needs of the people increase. Your own imagination can supply a long list of needs triggered by the increase in population.

What does all this mean to business? To an industry, such as machining? To us, in our special sphere of metalworking?

To business it means additional sales efforts either through an expanded force or a realignment of territory. It means additional appropriations for merchandising, sales promotion, advertising, marketing.

To an industry it means further efforts in technical research so that the products of the industry may be used better, may perform better, and last longer.

To you and to me it means a second and third look at the way we are performing certain operations. Have we improved them in the past few years? With the development of machine tools, cutting tools, grinding wheels, coolants, accessories, can we take advantage of them to increase the output of our particular department? Have we objectively analyzed our situation with a view toward improvement?

To up a company's business 10% over last year to stay even, and then up it an additional 10% to stay in the lead takes the combined efforts of every member of a company from the president on down. For, don't forget, next year another 10% will be added, and then another, and another. And suddenly, before we're

out of bed, we have three more competitors fighting for what should have been our business from the outset.

■ Lou Ballard, president of Micro-Path Inc. of Los Angeles, commented that the misconception of automation is largely motivated by an exaggerated belief that people are being eliminated by technological progress. To prove his point, he showed us a clipping from the August 29, 1960 edition of the LOS ANGELES MIRROR which headlined "Machinists Chart War on Automation." The news item reported that the International Assn. of Machinists was asked by its executive council to back an 8-point "defense plan" against automation. The alternative, worried the IAM council, would be mass unemployment.

"The truth is," says Ballard, "that people are being more fully utilized. They are learning to be more flexible in their skills; the working force and the number of jobs have increased steadily." Many well-known, well-established statistics were then reviewed to clinch the arguments.

He hates to say it, but Ballard pointed out that pressure from abroad, particularly from Russia, can no longer be ignored. "Russia," he says, "has already embarked upon a 5-billion-dollar government-sponsored program to introduce automation in industry. With the foreign competition we already have, our heads will be in the sand if we look to high tariffs for protection." • • •

By **Allen Young**  
Process Engineer  
Collins Radio Co.

# PROCESS ENGINEERING



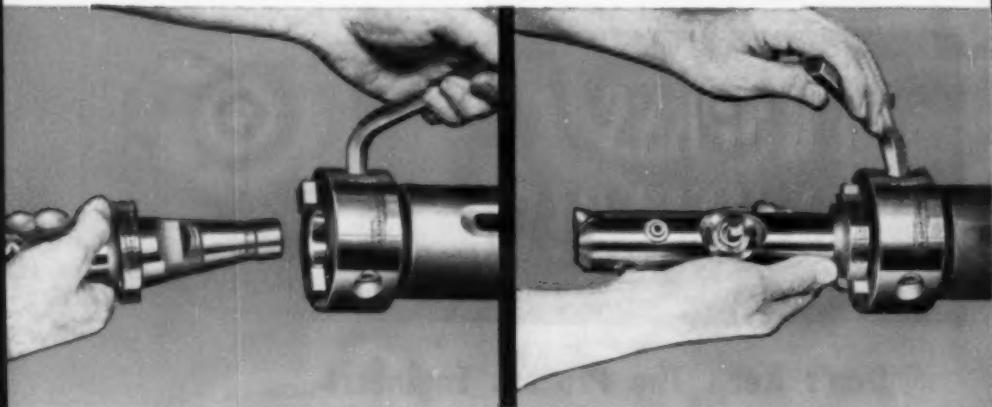
## Don't Keep The Process Engineers

### In The Dark On Machine Developments

■ During September, 1960, Engineers, Plant Managers, Purchasing Agents, and many other representatives of various phases of manufacturing saw, in Chicago, the greatest array of production equipment ever assembled. Since the procurement of new machinery by manufacturing plants in any field will affect the functions of Process Engineering to a very great degree, the Process Engineers should not only help to determine the need for new equipment, but they should be informed in detail upon the installation of any new machine as to just what can be expected of it.

A new piece of equipment is usually obtained for a specific purpose or to produce a specific type of piece-part or component. Upon observation of new machinery in action, the tool engineer, industrial engineer, methods engineer, or process researcher invariably asks "what else can we use it for?" Therefore some sort of formal or semi-formal indoctrination program concerning each new machine is imperative. A production engineer should never be allowed to program the production of parts by outmoded methods simply because he is not aware of the capabilities of recently acquired equipment. Just as ideas are exchanged among various departments in manufacturing, so should important knowledge about available machinery be shared by all concerned.

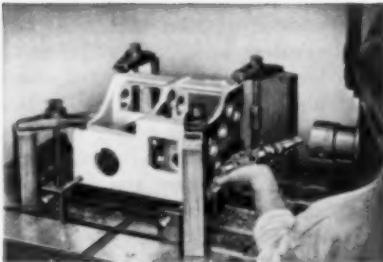
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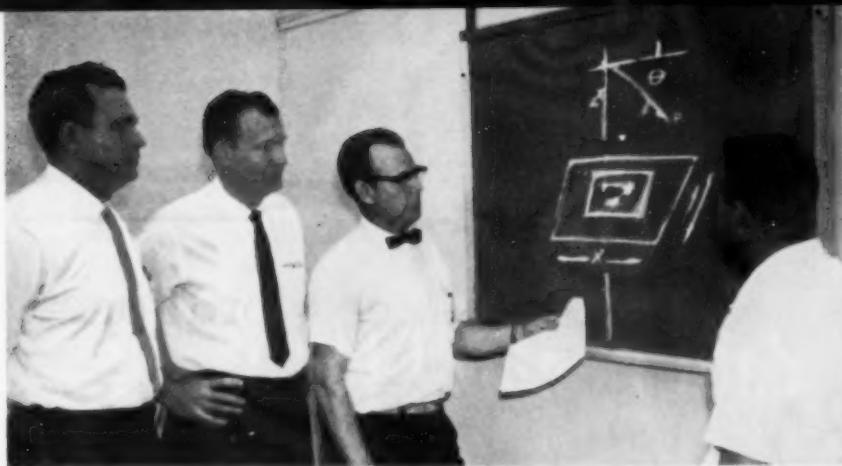
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A group of process engineers discusses machine motions needed for automatic inspection of difficult piece parts. The author is on the extreme left.

#### PROCESS ENGINEERING continued

A meeting, set up by department or division heads to discuss specific machines, is sometimes in order. Product design engineers, or research and development personnel, should also be kept similarly informed to allow better design for production. If the designer of a tight-toleranced part, for instance, had some idea of the producibility of the part, it would probably greatly influence the design of the part, even though his basic problem is to design for function.

The pre-release review, which is a meeting between product designers and production personnel to discuss new equipment ready to be released for manufacture, is usually an appropriate time to enlighten the product designer as to what is available in new production machinery and how we intend to use it to manufacture various types of parts or components. Which brings us right back to the importance of educating production engineers first.

With the advent of numerically controlled machine tools, a type of in-

formation filtering system and decision making body known as the Numerical Control Coordinating Committee has been necessitated. Most of us who are using numerics to any extent have formed such committees. This group is made up of representatives of various departments within the company whose actions will be influenced by numerically controlled machines. The purpose of the committee is to keep abreast of latest developments in this field, expedite the acquirement of new machinery of this type, and to generally keep all concerned advised of current and projected trends in numerics. Perhaps this same setup, on a smaller scale, could be applied to insure the flow of information on other types of machines to interested parties.

As previously mentioned, the importance of keeping all phases of Process Engineering informed as to available equipment, and educated in detail as to the capabilities of newly acquired equipment cannot be stressed too highly. • • •

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# CUTTING TOOLS

When considering machinability ratings . . .

## What Is A Realistic Starting Point?

By John A. Hedrick\*

■ The term "machinability" has been defined as the ease with which a given material may be worked with a cutting tool—but with consideration for many variables. When we consider a few of these variables such as material condition, material hardness, the material in the cutting tool, cutting tool geometry, rigidity of the tool and the workpiece, depth of cut, speed, feed, coolant, type of machine and the condition of the machine, we can conclude that the definition for "machinability" is a complex subject.

"Machinability Ratings" are a result of considerable study. These ratings have been compiled under laboratory conditions; examination will disclose that as many as twenty variables have been considered in establishing each rating. However, when we mention laboratory conditions to the average experienced man in the metalworking field, we are letting ourselves open for a rebuttal on the debate of theory versus practical application.

Regardless of debate, machinability ratings do have an important place in the metalworking field. Many men

\*Are machinability ratings really usable? John Hedrick disagrees with those who advocate that ratings are misleading unless tool life in minutes is considered. His point is, "What other yardstick is available?" Hedrick is a tool engineer with 24 years of experience. He is the author of *MACHINABILITY MANUAL* No. 1.

*Additional tests should be made  
in your plant on your equipment*

are not fortunate enough to have access to a statistical standards system that is common to a large plant operation.

Many times, machinability ratings are the only yardstick to provide a key to the machinability of a material not common to that particular plant. Even in a large plant operation, there is always a time when their accumulated statistical data does not include the information necessary to estimate a new job; the estimator must lean on the validity of a machinability rating chart.

Estimators and process planners will agree that the many thousands of statistics published each month on new accomplishments are always a case history of a job *already run*. Such case histories are usually the ultimate and the dreams of the future. The estimator and planner must be realistic about the job that is *yet to be run* and must use data relative to the operation of the plant in which they are employed.

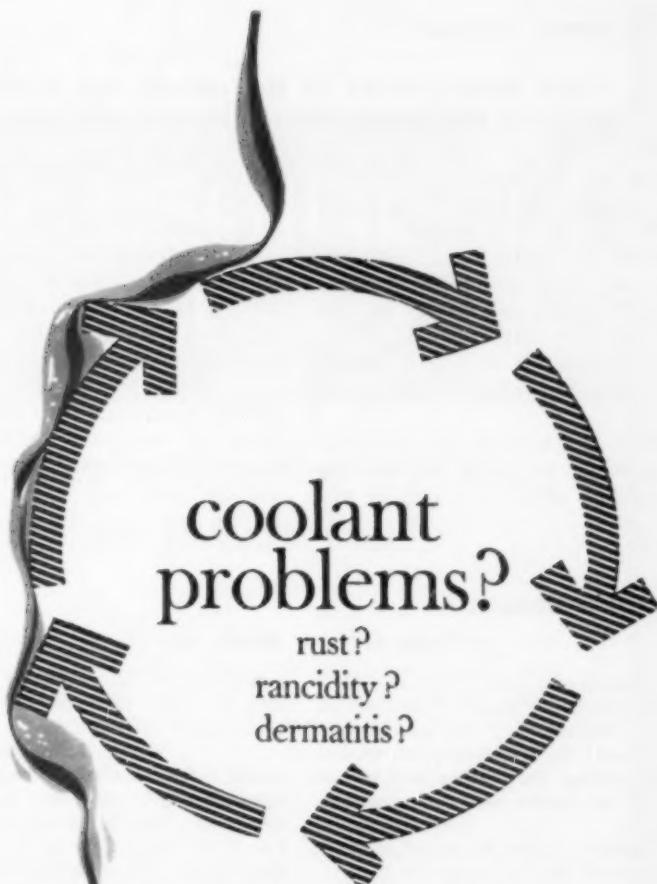
Machinability ratings can be invaluable if properly applied to suit the conditions peculiar to an individual shop.

A small amount of research will be necessary to establish a revised machinability rating chart applicable to a particular plant operation. The *first* step in this research is to determine if the chart selected is based on cold drawn or hot rolled material. This is important, because the per-

cent rating listed for a given material on the cold drawn chart may be different on the hot rolled chart. *Secondly*, it is best to select a chart that lists only the percent rating for each material so that SFPM can be added that are attainable in your own plant.

A rating chart can be constructed through several "on the job" tests beginning with SAE B-1112 cold drawn material which is rated on most charts at 100%. This first machining test should be made by simulating the average tool and workpiece setup rigidity, the average depth of cut, the average feed, the average coolant, the average tool grind, and performed on the machine in its average typical condition. Begin this test at 150 SFPM, which is considered to be the average speed for B-1112 using high speed cutting tools. Increase or decrease this SFPM until the average tool life expectancy has been gained. Several similar tests should be made on material rated at 70%, in which case the starting SFPM should be 70% of 150 SFPM or 105 SFPM; continue tests on 50% rated materials, and so on.

If these recommended tests cannot be performed and you desire to use a rating chart that has already been established and lists the recommended SFPM for each material, it is very important to take a good look at the SFPM listed for the 100% rated material. Charts are in existence where the 100% rated material has been de-



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October, 1960

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## *Final development of the speeds and feeds is up to the metalworking man in the shop*

termined to be machined at 185 SFPM; while other charts vary considerably in speeds to as low as 135 SFPM for the 100% rated material. If just any chart is selected for use where all speeds are based on 185 SFPM for the 100% rated material, it may be possible that such speeds are excessive for your particular plant operation.

If these precautions are followed, it is possible to revise an existing machinability chart that will be ap-

plicable. Such a chart can then be used with a good degree of confidence as a *realistic starting point* on that new job that is yet to be run. Final development of the speeds and feeds are up to the metalworking man in the shop. If he is the experienced machining expert that is necessary to meet present competition, he will be able to concentrate his efforts to remove the maximum cubic inches of metal at the most economical tool and operating cost. • • •

### *A reader comments . . .*

#### *about setting tools above or below center*

"In reference to the article on CUTTING TOOLS by Horace Frommelt in the July, 1960 issue, . . . his conclusions are incorrect in his discussion of the effect of setting the cutting tool above or below the center of rotation of the workpiece.

"The effective rake of a cutting tool is determined by the angle the face of the tool makes with the tangent of the outside diameter of the workpiece at the point of contact.

"The author should note in his illustration of o.d. turning, as in Figure 3, Page 93, that in moving a tool below center the effective back rake angle is decreased and the front relief angle is increased, while the opposite is true when a tool is set above center.

"For instance, if an o.d. turning tool is ground with 5° positive back rake and front relief angles and presented to a 2" diameter workpiece with the shank horizontal and the cutting point .087"

below center, the effective back rake will be zero and the effective front relief angle 10° positive."

G. R. D., Williamsport, Pa.  
Quite right. To clarify the many statements made in reference to back rake angles for turning operations we quote Leo J. St. Clair's "Design & Use of Cutting Tools": "To determine the effective back rake angle for an above-center setting one must add the positive center angle to the ground positive back rake angle and subtract it from a ground negative back rake angle. To determine the effective back rake angle when the point is below center, subtract the negative center angle from the ground positive back rake angle and add it to a ground negative back rake angle." • • •

Leo J. St. Clair, "Design And Use Of Cutting Tools", New York: McGraw-Hill Book Co., Inc., 1952.

By **Paul Prikos**  
Prikos & Becker Tool Co.  
Skokie, Illinois

5

# THE PRACTICAL DIEMAKER



## Which Rate Is Right When Pricing— \$6.00—\$7.00—\$8.00 Per Hour?

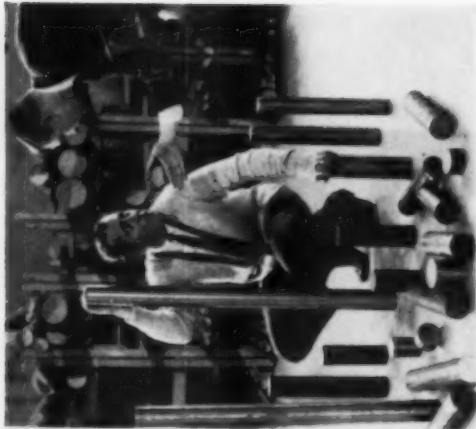
Part 1

■ Over the past year many readers have become cognizant of several articles on estimating that have appeared in this column. The basic theme throughout the estimating series has been to properly arrive at the necessary hours needed to produce a quality die. The rate per hour for pricing had been arbitrarily set at \$7.00 as a means to approximate the final die costs. This article and another one are aimed at the establishment of proper hourly rate or price. Thus, estimators or purchasers of dies, when asked what hourly rate is being charged, will be conversant at how such rates are established. I am personally convinced that most people do not know the rate currently acceptable in a given area. One might even say that there is a general capitulation to economic and accounting misconceptions of business facts that defy the very reason for corporate existence—namely to make a profit.

In this article, a portion of the standard income and expense sheet included in the general accounting statement will be used because only that portion is needed to develop the hourly rate. In contrast, the next article will explain why it is permissive to use a higher or lower rate, all other things being equal.

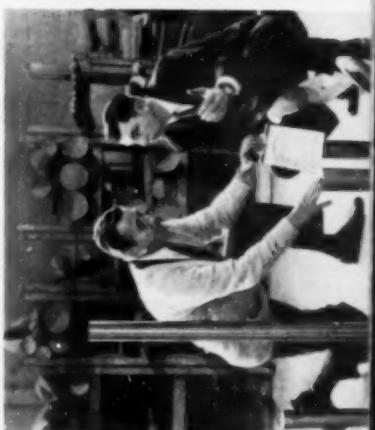
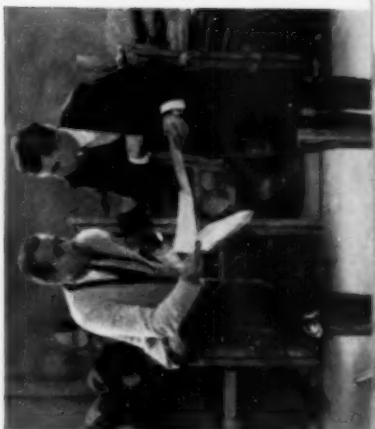
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CREATIVE ENGINEERING



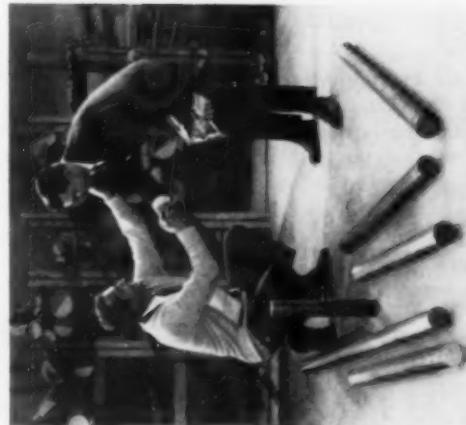
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## PRACTICAL DIEMAKER *continued*

## A TYPICAL TOOL & DIE SHOP-CORP.

**Project**—To arrive at an hourly rate through accounting procedure.  
**Given**—An average monthly balance sheet; income and expense sheet; and cost of goods sold sheet.

### I. Comparative Balance Sheet

### **Current Assets**

<i>Current Assets</i>		
Cash, Accounts Receivable .....	\$40,000.00	
<i>Current Liabilities</i>		Ratio of current assets to current liabilities
Accounts Payable, Accruals .....	\$20,000.00	2:1

## II. Profit & Loss or Income & Expense Statement

Sales . . . . .	\$20,000.00	\$22,000.00
Cost of goods sold . .	\$17,000.00	
Selling & Administra- tive Expenses . . . .	\$ 3,000.00	

\$20,000.00	\$20,000.00
Profit before taxes .....	\$ 2,000.00
Net profit after taxes .....	\$ 1,500.00
% of net profit to sales .....	7.5%

### III. Cost of Goods Sold

Purchases	.....	\$ 4,000.00
Direct Labor	.....	10,000.00
Mfg. Expenses		
Depreciation Exp.	..	3,000.00

\$17,000.00

## Developing the Hourly Rate from your Accounting Information

Direct Labor .....	\$10,000.00
Mfg. Expenses .....	3,000.00
Selling & Administra- tive Expense .....	3,000.00

**\$16,000.00**

### Hours of Direct Labor Per Month

$$(\text{employees}) \times (\text{hrs. per wk. work}) \times (\text{wks. per mo.}) = 2660 \text{ hrs.}$$

$$(\text{No profits}) \quad \$16,000.00 \div 2660 \text{ hrs.} = \$6.00 \text{ rate per hr.}$$

(With profit \$18,000.00  $\div$  2660 hrs. = \$6.75 rate per hr.  
shown before)

We now have a drop in business (sales) by 10%

Direct Labor . . . . .	\$ 9,000.00
*Mfg. Expenses . . . . .	3,000.00
Selling & Adminis- trative Expense . . . . .	3,000.00
	_____
	\$15,000.00

(No profits) \$15,000.00  $\div$  2394 hrs. = \$6.25 rate per hour  
(With profits \$17,000.00  $\div$  2394 hrs. = \$7.10 rate per hour  
shown before)

*Analysis*—A 10% drop in business (sales) results in a necessary  
increase of the hourly rate by about 5%.

We now have a recession and sales drop by 20%.

Direct Labor . . . . .	\$ 8,000.00
Mfg. Expenses . . . . .	3,000.00
Selling & Adminis- trative . . . . .	3,000.00
	_____
	\$14,000.00

(no profits) \$14,000.00  $\div$  2118 hrs. = \$6.60 rate per hr.  
(with profits \$16,000.00  $\div$  2118 hrs. = \$7.55 rate per hr.  
shown before)

*Analysis*—A 20% drop in business (sales) results in a necessary  
increase in the hourly rate by about 10%.

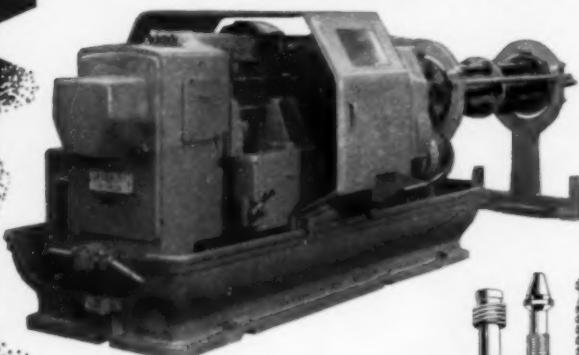
While the above accounting picture is condensed and hypothetical, it is not too far from reality if some of the nation's tool and die shops balance sheets were carefully analyzed. It also indicates the importance of knowing your costs and quoting the right price.

For those readers who are in manu-

facturing, do not be cajoled into the belief that captive toolrooms need only be priced at the toolmakers' hourly pay. The overhead burden is more likely to be equal or higher than a qualified job shop. The accounting department of any large corporation will easily prove to you the true hourly cost in your toolroom. • • •

\*This would usually change, but to prevent too many changes it will remain constant for explanatory reasons only.

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MACHINE and TOOL BLUE BOOK



## WHEN— AND HOW MUCH— SHOULD YOU INVEST IN TOOLING?

By **Harry Conn**, Chief Engineer  
Scully-Jones & Co., Chicago, Ill.

■ There are several very good formulae and economic analysis systems for evaluating new machine tool purchases, but a crying need continues in the field of economics for ways to enable an engineer correctly to weigh or justify the tools for machines, whether the machines are new or already in use. Often the tools used on a machine cost more than does the machine itself before it is written off or becomes obsolete. Surely the economics of tooling is as important as is the economics of the machine and can be just as exact.

When considering and planning a tooling program it is just as important to know how to compute the economic justification as it is to know how to design the actual tools. In fact, without economic justification, the designer does not know how much the tool should cost and although his design is often an engineering masterpiece it is economically a "Shot in the Dark." The besetting sin of tool designers and toolmakers is to tie up money in jigs and fixtures which may show an attractive savings when used, but which are actually seldom put to use.

## *Depreciation is made up of two factors --*

A saving of 8 per cent in direct labor cost on a job in constant use may justify greater expense in tooling than a saving of 90 per cent on a small job which is run only once or twice a year.

Tooling may be desirable even when only small quantities are involved, but the economic advantage of lower labor costs is the controlling factor unless some other consideration, such as improved interchangeability, increased accuracy, or minimizing of labor trouble intervenes. Usually, where these latter reasons alone would have necessitated a fixture, it is found that the fixture lowers costs.<sup>1</sup>

When the average engineer is asked to justify tooling and take into account depreciation, interest, obsolescence and other forms of overhead, he shrugs it off with a remark such as "Let the accountants do it." The accountants say "Let the engineers do it" and consequently it doesn't get done by anyone. Most jobs are therefore either over-tooled or under-tooled. In many plants the engineers can't obtain the information needed to make an accurate economic study. Some of the factors such as interest rate, taxes, etc., may be taken as constant and brought together for simplification. Included in this article are some of these values which may be helpful.

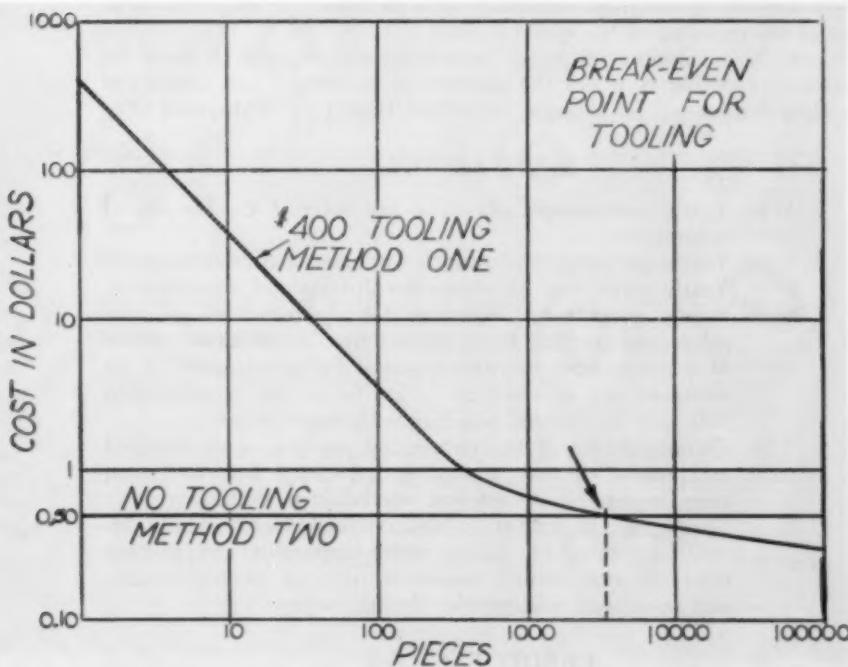
With fixtures, as with other types of equipment, depreciation is made up of two factors, deterioration and obsolescence. As a rule, they are not the same or equal. In one case deterioration due to wear may be the chief factor. More often obsolescence due to liability of change in models or design may control depreciation. The one should be used which operates the fastest.

As for depreciation, in line with prevailing practices, a prominent tool manufacturer has recommended that standard tools, which may be used interchangeably, can safely be depreciated in approximately 2 years; but that special tools—applicable to only one job, model, or product—should have a depreciation period of one year, one season, or one model. Perishable tools which wear away with use should be taken into account and charged for in accordance with their expected impermanence.<sup>3</sup>

There are many problems and questions that can be solved and answered when considering the economics of tooling. The classic work in tool economics was done by Professor J. W. Roe and was published in "Mechanical Engineering", February, 1941. It was called "Principles of Jigs and Fixtures." The main problem of economics of tooling are found in one or more of the following questions:

## *deterioration and obsolescence.*

1. *How many pieces must be run to pay for a fixture of given estimated cost that will show a given estimated saving in direct labor cost per piece? For instance, how low a run will justify a fixture costing \$400 to save 3 cents on direct labor cost of each piece? Use Equation [1]*
2. *How much may a fixture cost that will show a given estimated unit-saving in direct-labor cost on a given number of pieces? For instance, how much can be put into a fixture to "break even" on a run of 10,000 pieces, if the fixture can save 3 cents on the direct-labor cost of each piece? Use Equation [2]*



1. Two methods are graphed; one with tooling, one without. For purposes of illustration, the author has disregarded the learning curve where no tools are used.

## INVESTING IN TOOLING continued

3. *Under given conditions, how long will it take a proposed fixture to pay for itself, carrying its fixed charges while so doing?* For instance, how long will it take a fixture costing \$400 to pay for itself if it saves 3 cents on direct labor cost per unit, production being at a given rate? Use Equation [4]

Questions 1, 2 and 3 assume that we just break even. There is also the very practical question:

4. *What profit will be earned by a fixture of a given cost for an estimated unit saving in direct labor cost and given output?* For instance, what will be the profit on a \$200 fixture if it will save in direct labor cost 3 cents a piece on 10,000 pieces? Use Equation [3].

For a thorough understanding and for obtaining accurate answers to our problems, the economic factors must be listed and defined. Our problems will be solved by one of the four formulae which we will list, but to use them accurately it is necessary to have clearly in mind the meaning of the symbols used.

Let:  $N$  = number of pieces manufactured per year. It must be remembered that  $N$  is not the number of pieces per run unless the tooling is intended for a single run of less than a year's duration.

### DEBIT FACTORS

$A$  = Yearly percentage allowance for interest on the initial investment.

$B$  = Yearly percentage allowance for taxes and insurance.

$C$  = Yearly percentage allowance for upkeep and maintenance.

$1/H$  = Yearly percentage allowance for depreciation and obsolescence on the basis of uniform depreciation where  $H$  is the number of years required for amortization of investment out of earnings. (This factor for simplification will later be lumped together with some others.)

$I$  = Estimated cost of the fixture, jig, etc, i.e., cost installed and ready to run, including designing and tool-room time, material and toolroom overhead, in dollars.

$Y$  = Yearly cost of setups in dollars: This factor should include expenses for taking down apparatus and putting machine into normal condition, cost of issuing orders, and overhead chargeable during setup.

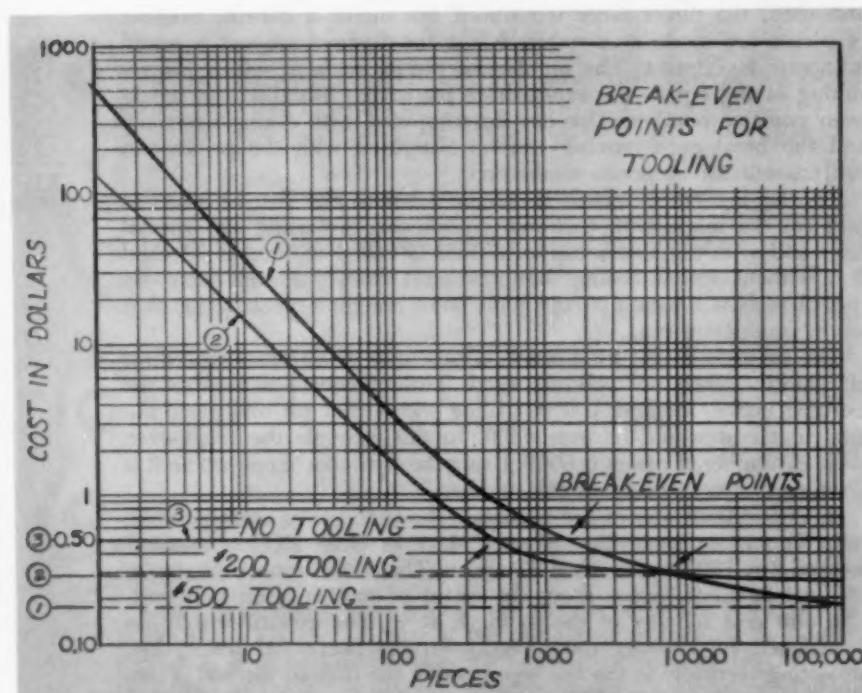
### CREDIT FACTORS

$S$  = Yearly saving in direct cost of labor in dollars.  
=  $N x$  (old unit labor cost, minus the new labor cost).

$= N x$  (saving in labor cost)  
 $= Ns$ . This covers only direct unit labor cost.  
 $s$  = Saving in unit labor cost.  
 $t$  = The overhead percentage used on the labor saved.  
 $V$  = Yearly net operating profit, in excess of fixed charges, in dollars.

These questions involve something more than the simple arithmetic which might seem to be all that is necessary for answering them, because, while the credit items for the fixtures depend mainly on the number of pieces machined, the debit items involve time, and also the number of setups required, i.e., whether the pieces are run off continuously or in a number of runs.

Today an important time element enters in when many companies require that any new equipment shall pay for itself in a certain period. Various investigations show wide variation in practice as to



2. Three different methods are graphed showing their corresponding costs at various quantities. The break-even point for any situation can be computed from the formulas stated in the article.

***The modern way to compute economic justification should be to multiply the direct labor savings in minutes by the production value (in dollars and cents) of the machine's output per minute.***

this requirement, ranging from one to six or seven years. The general practice seems to be about two years, but conditions even within one shop might warrant lengthening or shortening this period for different specific cases. In a job shop the tool must pay for itself during the production run for which it is made.

Almost every production job that is run can be made on a toolroom basis, using no special tools. When jigs or fixtures are made and used, the direct labor is reduced but unless a definite number of pieces are made at a reduced cost the fixtures are not a sound economic investment. The number of pieces made at which the resulting saving equals the expenditure for tooling is called the break-even point or number. This can be computed with a single formula and the break-even number can be compared with the production run amount for economic evaluation.

The log-log graph shown in Figure 1 shows the cost at which a part can be made with toolroom equipment, not using any special tools and with negligible setup cost. This is called method 2. Method 2 is without special tooling but method 1 utilizes special tools. By special tools is meant that the tools were bought especially for that job or production run.

The example in Figure 1 shows a unit cost of 50 cents regardless of quantity when no tools are used. This of course disregards the learning curve. Method 1 with tooling shows that for one piece the total unit cost would be over \$400. In this example the break-even point in number of pieces is 6000. Using the formulae in our article it is a simple matter to compute this number.

In Figure 2 are shown 3 different methods and their corresponding costs at various quantities. Method 1 is to have \$500 in tooling; method 2 is \$200 and method 3 is none. The three numbers in circles at the lower left corner show the effect of tooling upon unit cost. The unit cost for any of the methods at various quantities may be determined by locating the quantity on the horizontal scale, then projecting vertically to the line representing the desired method. From that line or point project horizontally to the left hand scale or ordinate and read the unit cost for that quantity.

To illustrate economic analysis of a fixture by the use of formulae we must have values for our factors. Then assume the following data:

Estimated unit saving in direct labor cost called factor $s$	= 3 cents
Burden on labor saved signified by $t$	= 50 per cent
Estimated cost of each setup	= \$10
$A$	= 6 per cent
$B$	= 4 per cent
$C$	= 10 per cent
$H$	= 2 years
$1/H$	= 50 per cent
$A + B + C + 1/H$	= 70 per cent

To find the number of pieces required for a given cost  $I$  we have, solving for  $N$

$$N = \frac{I(A + B + C + 1/H) + Y}{s(1 + t)} \quad \text{Equation [1]}$$

To find the cost  $I$  which will just earn fixed charges we have, solving Equation [1] for  $I$

$$I = \frac{Ns(1 + t) - Y}{A + B + C + 1/H} = \quad \text{Equation [2]}$$

To find the net operating profit over all fixed charges we have,  $V$  = gross operating profit, less set ups and fixed charges.

$$V = Ns(1 + t) - Y - I(A + B + C + 1/H) \quad \text{Equation [3]}$$

To find the time  $H$  in years for the fixture to just pay for itself, Roe used this equation:

$$H = \frac{I}{Ns(1 + t) - Y - I(A + B + C)} \quad \text{Equation [4]}$$

In using the formulae it must be remembered that  $N$  is the number of pieces manufactured in a year, not per run, except for the case of a single run of less than one year's duration.

Items  $A$ ,  $B$ , and  $C$  having been established, need but little change. If the plant has the practice of requiring new equipment to pay for itself in a definite time  $H$ , say two years, the depreciation  $1/H$  may be added to the other carrying charges, making a single percentage factor for the term  $(A + B + C + 1/H)$  which may be used until management deems that changed conditions require modification.

To illustrate the applications of these formulae we will work several

***When planning a tooling program, it is just as important to know how to compute the economic justification of the program as it is to know how to design the actual tools.***

problems. If  $I = \$400$ , to find the number of pieces to be put through each year in one run per year, we have from Equation [1]

$$N = \frac{\$400 \times 0.70 + \$10}{\$0.03 \times 1.5} = 6444 \text{ pieces}$$

That is, if a \$400 fixture is a pay for itself in 2 years and carry overhead with a single run per year, at least 6444 pieces must be put through each year. If, instead, the pieces are put through in 6 runs per year, then,

$$N = \frac{\$400 \times 0.70 + \$60}{\$0.045} = 7555 \text{ pieces}$$

More pieces must be run per year due obviously to the increased number of setups. The setup costs were increased from \$10 to \$60.

There is of course a breaking point where it pays to have multiple runs, even at a higher production cost per piece, due to the balancing of production cost and fixed charges on increased inventory. It becomes a problem in economics that is called economic lot size and does not come within the scope of this study.

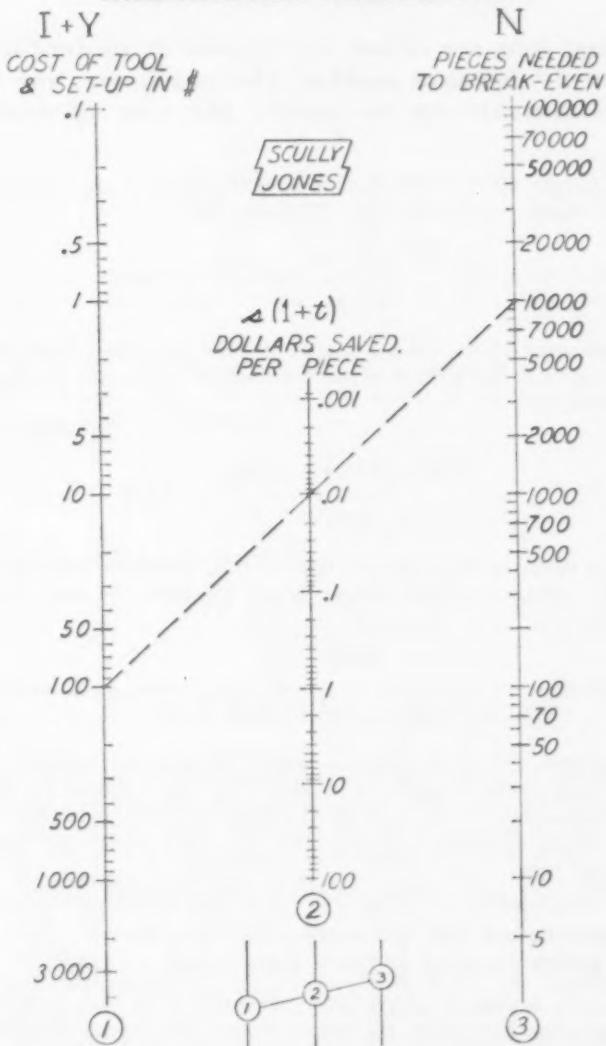
Suppose the fixture or jig is to pay for itself in a single run. How many pieces must be made during the run? In this case,  $H$  is unity as the tool must pay for itself within the year or run, and  $A + B + C + 1/H = 6\% + 4\% + 10\% + 100\% = 120\%$ , then,

$$N = \frac{\$400 \times 1.20 + \$10}{\$0.045} = 10,888 \text{ pieces}$$

This shows that a smaller total output is required than when 6444 pieces are called for, for two years, or 12,888, due to one less setup and carrying the overhead for only one year instead of two. It will be noted that this assumes the full-year values for  $A$ ,  $B$ , and  $C$ . If the run is short and it is felt that this is too drastic, the values could be cut down to one year in the proportion of the actual running time.

Reversing the foregoing assumptions, how much money could we

## **BREAK-EVEN NOMOGRAM**



3. The number of pieces necessary to break-even on production jobs of short duration of time may be found by means of this nomograph. The author comments that too much emphasis is placed on direct labor savings, that production value of machines should be considered. The result: up-to-date tooling on up-to-date machine tools.

**Most jobs are either over-tooled or under-tooled simply because neither the engineers nor the accountants try to justify the cost of tooling**

put into a fixture for a single run of 10,900 pieces at an estimated savings of 3 cents per piece? From Equation [2]

$$I = \frac{10,900 \times \$0.045 - \$10}{1.20} = \$400$$

Also, if we want 7550 pieces a year in six runs per year (Economic Lot Size) and want the fixture to pay for itself in two years, we have from Equation [2]

Equation [5]

$$I = \frac{7550 \times \$0.045 - \$60}{0.70} = \$400$$

Should we want to know the reverse of this, namely, how long a time would it take for a \$400 fixture to pay for itself, we have from Equation [4]

$$H = \frac{\$400}{7550 \times \$0.045 - \$60 - \$400 \times 0.20} = 2 \text{ years}$$

From Equation [5] we see that we would "break-even" with a cost of \$400 at 7550 pieces. Should we be able to design a fixture for the same conditions which would cost \$250 instead of \$400, what will be the profit? Using Equation [3] we have for 7550 pieces per year in six runs per year

$$V = 7550 \times 0.045 - \$60 - \$250 \times 0.70 = \$105 \text{ per yr.}$$

For a single run of 10,900 pieces the profit would be

$$V = 10,900 \times \$0.045 - \$10 - \$250 \times 1.20 = \$180.50$$

To be able to determine which fixture to build when both perform the same operation but return different savings and require different setup cost, Equation [2] is used. For instance, for a single run of 2000 pieces, under the foregoing condition, how much can we afford to:

- (a) Put into a fixture if it will save 3 cents per unit, with a setup cost of \$10 or

(b) Put into a more refined fixture which will save 5 cents per unit, with a setup cost of \$15.

From Equation [2]

$$\text{For (a)} \quad I_a = \frac{2000 \times \$0.03 \times 1.5 - \$10}{1.20} = \$66.66$$

$$\text{For (b)} \quad I_b = \frac{2000 \times \$0.05 \times 1.5 - \$15}{1.20} = \$112.50$$

It is quite obvious the same formulae may be used to compare the amounts which might be put into fixtures for different lengths of run.

If the die, fixture, jig, cutting tool or gage is to be used on a job that will only last a few weeks or a very short time the break-even formula may be simplified to:

$$N = \frac{I + Y}{s(1 + t)} \quad \text{Equation [6]}$$

Number of pieces to break-even =

$$N = \frac{\text{Cost of Tooling} + \text{Set-up Cost}}{\text{Savings per part}}$$

For production jobs of short duration in time the formula  $(A + B + C + 1/H)$  of Equation [1] can be neglected or eliminated.

The nomograph in Figure 3 can be used to find  $N$  of Equation [6] by locating the cost of the tooling plus the set-up cost on line 1. Then connect the point on line 1 to the point on line 2 that corresponds with the savings per part. Then extend the line from the point on line 1 through the point on line 2 to line 3 and read the number of pieces needed to break-even or justify the tooling and setup cost.

The preceding examples show how the formulae proposed by J. W. Roe help in deciding the correct design of tooling because the design determines the cost. It is admitted that the overhead charges applied to direct labor are far too conservative  $(1 + t)$ .

The preceding has been the classical (although almost unused) approach to economics of tooling. It needs to be modernized. The preceding formulae put too much stress on direct labor savings. In some modern manufacturing plants direct labor is a small part of total cost. Some automobile engines are machined and completely assembled with less than a total of 7 hours of direct labor. If the

*In many modern plants direct labor  
is a small part of total cost*

direct labor were obtained free of charge it wouldn't make much difference in the selling price. Naturally this thought does not apply to plants that are not engaged in high production.

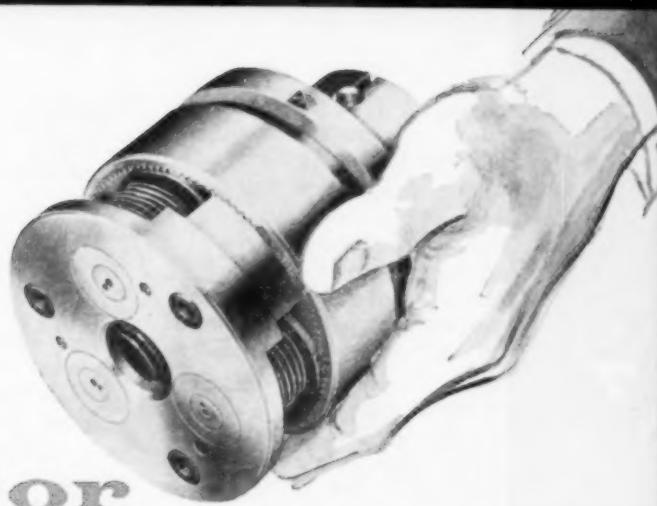
The modern way to compute economic justification should be to multiply the direct labor savings in minutes by the production value (in dollars and cents) of the machine tool's output per minute, instead of using  $(1 + t)$ . For instance, a \$300 fixture that saves 1 minute per part machined in a \$300,000 machine is worth more and can be justified more easily than a \$300 fixture that saves 1 minute of direct labor in a \$30,000 machine. Many will say that this practice would be compensated for in the increased burden or overhead applied to the labor used on the \$300,000 machine, but industry does not do it.

A definition of "Production Value" is that, if the work, operation or service performed upon the parts in one hour can be sold for \$12, \$25, \$1200 or \$1800 (for transfer machines and automation installations) this is its value to the company. If a minute is saved it is worth 20 cents, 40 cents, \$20 or \$30 depending on the amount invested in the machine that uses the tools. If savings were computed in this manner, industry would begin to get 25 to 75 per cent more production out of its equipment, thereby reducing burden or overhead per unit shipped and thereby intentionally swallowing the camel instead of the gnat.

Industry will see its largest potential for savings or reduction in cost and increased output when it understands the  $s(1 + t)$  of the preceding formulae and corrects them. Comprehension of this factor will cause manufacturers to demand modern tooling with modern machines instead of the prevalent machines with 50 year old tooling and machining concepts. Modern tooling which many engineers do not know exists can be justified and used. When modern tooling is applied by all, then comes the second Industrial Revolution!

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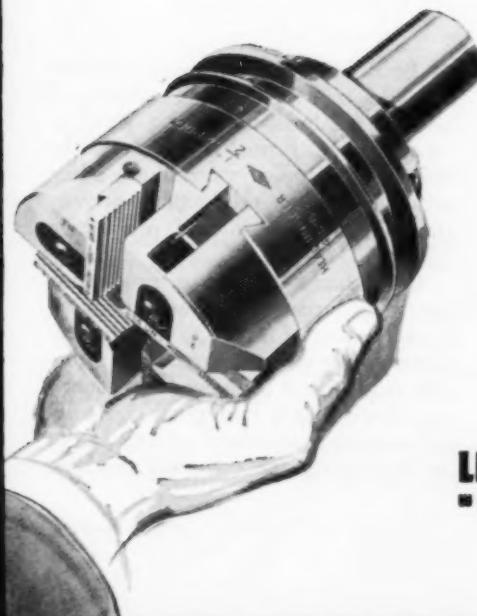


## CUT or ROLL threads?

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"At times . . . . too many orders and too few people."

## Why Put Off Practical Control Of Production?

By **Richard W. Landon**  
Management Consultant  
Cresap, McCormick and Poget  
Chicago, Illinois

■ Be it one man who plans and executes his own production, carrying all necessary information in his head, or be it a large, formal organization developing complex, machine-loading schedules, any production activity must have some sort of production control.

In too many companies, production control is carried out on an expediting basis because of failure to develop any rational, workable system. This situation is prevalent in many job or short-run shops which find great difficulty in assembling standard information or in developing the complete machine

or department schedules often associated with production control.

### Growth May Mean Confusion

The very small operation has no real production control problem simply because at any one time only one, or at any rate, very few, orders are in progress. The owner, who probably is the salesman as well as the production foreman, carries all necessary scheduling information in his head.

As the company grows, the standard pattern is for sales to retain control over scheduling through issuance of shop orders and through advice to the production superintendent on the priority of orders.

The next stage in growth often



*"The owner, in small operations, carries the necessary production schedules in his head."*

comes pretty close to chaos—too many orders, too many people. Production is usually under considerable pressure to economize on labor and investment in facilities and inventory. In such instances, the customer actually takes over production control on a "he who

hollers loudest and longest gets it first" system. Production costs inevitably begin to rise and customer satisfaction begins to sink.

A specialty metal company cried for help when it found only 20 to 30 per cent of its orders were going out on time, that inventories were rising and customer complaints were mounting seriously. This is the dilemma that confronted them:

1. In order to produce the greatest volume, sales wanted the shortest possible delivery periods and would have preferred to ship everything from shelf stocks.

2. Production wanted long delivery periods to permit the most economical scheduling of labor and equipment.

3. General management stood some place in the middle wanting maximum volume, minimum production cost and, with it all, the minimum investment in inventory.

How can this dilemma be solved?

A properly conceived production control program can best meet the scheduling requirements for sales, production and general management. Production control is a coordinating function between general management policies. It must have the whole-hearted support of general management if it is to produce results. It is, in fact, an extension of general management.

### Basic Information Required

What are the fundamental requirements for information in a production control program?

1. Sales orders must be completed with all necessary specifications to permit production and shipment of the right quantity of the right product

*Determination of the proper sequence of individual operations is the most difficult job in scheduling*



"Orders should never be transmitted with meaningless RUSH or S.A.P. requests."

at the right time. The sales orders should include the customer's requested shipment date. It should never be transmitted with a meaningless S. A. P. (soon as possible) or RUSH request. Production control can do nothing except schedule at the end of the line when no delivery request is made.

Provisions should be made for the engineering department to provide necessary specifications and information prior to the time the order is scheduled into the shop.

One machine shop, with a well-developed machine scheduling system, discovered that the reason for its late shipments was that engineering was scheduling on a first-come, first-served basis.

2. In order to schedule, production control has to know what it is scheduling. This may sound elementary, but, in too many cases, the only persons who actually know the specification and manufacturing methods for particular products are on the production floor. Drawings and specifications may be available, but the shop may well have made corrections and changes which never got back to engineering. Processes are too often found only in a foreman's "little black book" or in somebody's head.

A production control system cannot succeed on personal memory. It is necessary that drawings and specifications be kept up to date. Process records describing the manufacture of each product must be available. A complete file may be built up at one time, or the records may be accumulated as each order is received. These records may be compiled by engineers or they may be noted in very simple terms by shop foremen. The better the records, the better the control job.

3. Accurate determination of the proper sequence of individual operations is the most difficult job in production scheduling. While it is possible to make a precise operation schedule for any given set of orders, it is impractical to do so in many job-shop situations, at least for any extended period of time. It is possible that each new order may cause a complete rescheduling if the greatest economy of operation is to be maintained.

Job shops often attempt to control production by the use of lead times applied to each order. Lead-time values are used which supposedly will allow orders to flow smoothly through the shop. Invariably, however, considerable expediting is necessary to push the important orders through.

***Lead-time values are meaningless if they are not related to production capacity and to current backlog.***

#### **Lead Time As A Scheduling Tool**

If the use of lead time is properly understood and applied, it becomes a powerful scheduling tool. Let us define operating lead time as the time between the start of one operation and the start of the next operation in the process sequence for any product.

The operating times may be carefully engineered standards considering all elements of production, handling, transfer, normal delays to permit economical sequencing with other products or set-ups, inspection, packaging, transportation, etc., as related to each product. Values also may be obtained from accounting records or job histories. Shop personnel, if pressed, can usually come up with fairly accurate estimates of the normal length of time, in days or weeks, required to move any particular product through each shop operation.

These operating lead-time values do not express actual production time requirements. They do tell the normal amount of time required to accomplish each operation without special handling and without undue delays through being displaced by high priority orders. They determine a time allowance which will usually permit

the shop to meet its delivery promise. Any less time gives a good chance of late delivery; any more time simply means the product sits around unnecessarily.

The operating lead-time values will change if the product mix changes to any marked degree, as manufacturing techniques and facilities change and as general management policies change. Rarely do such changes take place rapidly or in large numbers.

The *total lead time* required for production is the *sum* of the individual operating lead times, assuming that there is open capacity at the scheduled start of each operation. If capacity to absorb another order is lacking for any particular operation, then that operation and each subsequent operation must be delayed until a period when production time is available. Consequently, the total lead time will vary as the backlog varies. It can never be shorter than the sum of the individual operating lead times, but it may extend to any length dictated by the order backlog.

continued



*"General management stands some place in the middle."*



"The better the records, the better the control job."

### Setting Up Master Schedules

Master schedules, for future periods where open capacity is known to be available, can be developed using total lead-time values—the sum of the individual operating lead times. Details must be added in adequate time to prevent conflicts from developing with orders entered at a later date but with shorter delivery periods. Detail schedules are prepared, as described above, by scheduling each operation (or group of operations) after the proper lead time and in a period of open production capacity. Because the schedule is based on a probable time requirement rather than a precise loading of production facilities, orders in the schedule can be changed up to the last minute before issuance. The precise shop sequence, then, is developed by the shop supervisor on the basis of the best operation to comply with the weekly production requirement and in view of the operating lead times he knows production control is using.

*The concept presented here is to use operating lead times for individual or closely related groups of operations—even though the values may be relatively imprecise—together with the available production capacity in order to yield production schedules with a high probability for on time delivery.*

### Plant Capacity Must Be Known

4. It is necessary to determine when the production facility is being used to capacity. Overloading the plant is the surest way to miss delivery promises. Underloading is obviously expensive.

The most precise method is to equate standard time requirements for individual operations for each quantity of product against the available operating time during the period covered by the schedule. This can be an extremely difficult problem to solve even with the very best data. And, in a good many job shop situations,

accurate data just isn't available.

There is always some common denominator that can be found to measure production. If any particular operation is a real bottleneck, then it becomes the capacity control. Weight of product, sales value, aggregate number of items or even the total number of orders during the schedule period are figures that may prove useful in indicating the probable quantity of goods that can be produced. Here again, ultimate precision is not nearly so important as the determination of values which will give a high probability of providing the desired measurement.

5. Control, or at least complete and continuous knowledge, of inventory position is required if production control is to be effective. The finished goods inventory is necessary if any goods are to be shipped directly from stock. Information on raw materials and semi-finished goods must be available to determine when it is feasible to start an order.

Actually, it is possible to separate raw material or finished goods inventory control from production scheduling providing the limitations are recognized. For some applications, it may be desirable for sales or an independent activity to control finished goods. In such a case, production control merely assumes there is no finished goods inventory and honors inventory replenishment orders exactly as any other customer order. If raw materials are thoroughly standardized, it may be desirable to give inventory control of these items to a separate material control activity or possibly to the purchasing activity. Here production control bases schedules on the

assumption that raw materials will always be available.

Under normal circumstances, inventory control should be under the same authority as production control, operating under general management's investment policies.

6. Finally, effective production control requires continuous or at least frequent information on the status of each order. Often it is practical to determine such information directly from the job cards made out for each operation. In other cases, it is necessary to develop new procedures for specific recording of job progress.

#### **And, In The End**

What results can be expected of a properly installed production control system?

- ✓ Shipment promises stating the expected delivery period for each order.
- ✓ Shipping schedules for each shipping period showing the quantity of product to be shipped on order.
- ✓ Notification when shipment is to be missed, stating reason for delay and giving a new delivery promise.
- ✓ Production schedules showing all orders to be completed during the schedule period. Such schedules may be by machine, department or plant as required.
- ✓ Performance reports. The primary report to management is one showing performance with respect to on-time shipments and presenting required details on orders missed.

#### **Establishing A System**

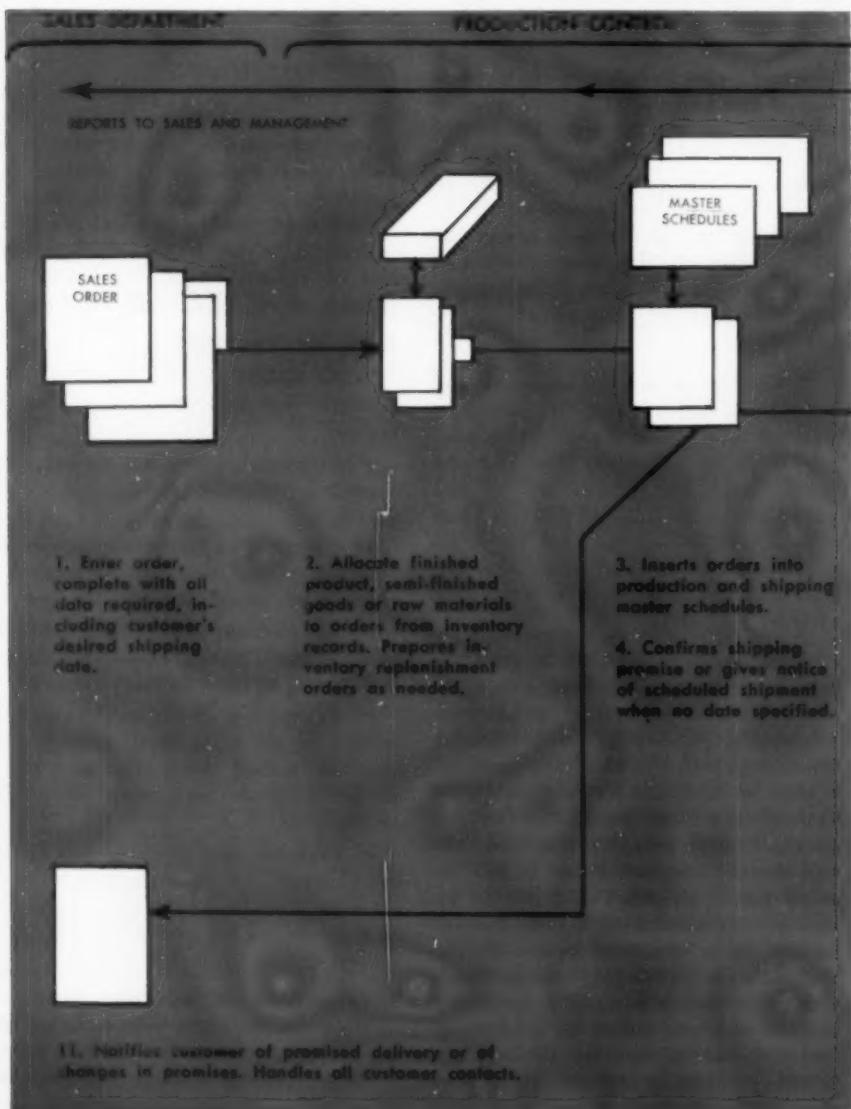
What are the steps in installation of a production control system?

1. Develop the complete procedure on paper including all the pertinent

## ESTABLISHING PRODUCTION CONTROL continued

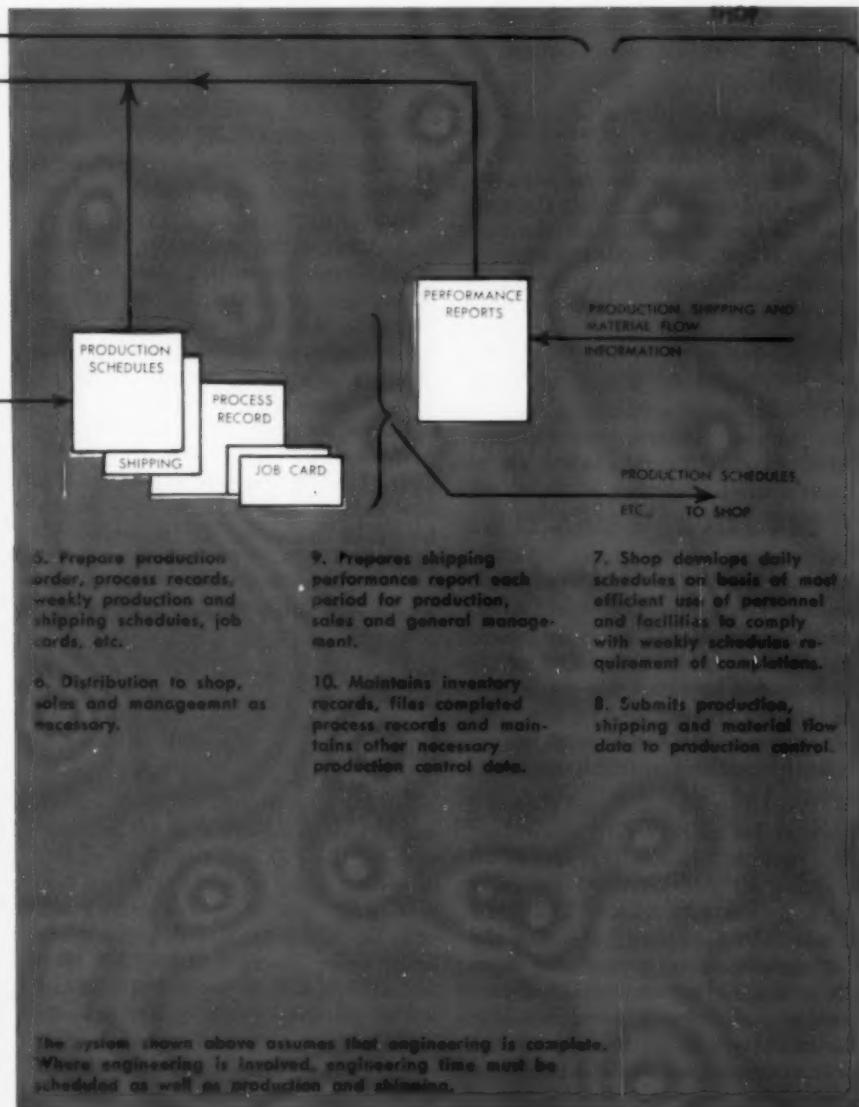
steps from order entry through to the preparation of the desired perform-

ance reports. An abbreviated schematic diagram for a typical production



control system is shown on Exhibit 1. This system includes elements of order entry, inventory control (allocation of materials or products to production

or shipping), master scheduling, detail schedule preparation, production reporting and performance reporting. For simplification, the diagram does



*Production control is not a cost cutting device,  
it should be evaluated by overall company results*

not include the acquisition of information from engineering or changes to established schedules.

2. Once the procedure has been developed and approved, select the personnel and carefully explain the system to everyone involved including general management, sales, engineering and production.
3. Obtain the necessary new paperwork forms and initiate their use as suitable.

4. Transfer inventory records and control to production control or as specified in the approved procedure.

5. Determine and schedule all unfilled orders for a proper, specific shipping period. This master schedule should include all entered orders whatever their status may be in engineering, production, or otherwise. New orders should be fitted into the schedules as they are received on the basis of customer's delivery request, standard lead times and available capacity.

6. Prepare production and shipping schedules for immediately succeeding time periods. Normally, detailed schedules are not prepared for more than a month in advance. Distribute the schedules far enough ahead of the schedule period to permit the foremen to make their own detailed personnel and equipment schedules. Distribution of schedules to foremen too far in advance can lead to problems in schedule variations due to opera-

tion for production convenience rather than schedule requirement.

7. Work closely with the foremen to provide interpretation or changes needed to meet the schedule requirements.

8. Analyze the production and shipping reports recording necessary information to maintain surveillance over the status of scheduled orders. Advise sales immediately on schedule changes affecting delivery promises.

9. Prepare timely reports to management on production and shipping performance.

10. Update standard information as new data is received or review of performance indicates the necessity for change.

**Formal Policy Must Be Stated**

In order to have a production control system succeed fully, management needs to make some definite policy decisions and carry them through consistently:

**Sales.** Sales must take full responsibility for all customer contacts including the determination of all information for the full and complete editing of orders. Sales should handle all contact with customers concerning advice on order status, delivery problems, order changes, etc. Sales must not accept orders beyond the capacity to produce. New orders may be introduced into a full schedule provided it is accomplished on a substitution basis by removing previously

scheduled orders. Orders for short delivery cannot be accepted without explicit agreement with production control.

**Production.** Production must adhere to the production and shipping schedules unless specific approval is obtained from production control for a change. Work must not be expended on non-scheduled orders without express approval.

**General Management.** The role of general management is critically important. It must provide the policy direction to permit production control to coordinate sales and production requirements with inventory investment in the best interest of the company.

Personnel requirements will differ in each case. Usually the introduction of a production control system does not actually increase the total clerical workload. It will cause shifts in the work, however, which may have the apparent effect of increased personnel requirements. For instance, it may be desirable to decrease the clerical entries formerly made by the foremen and to combine them under a production control clerk. This frees the foremen to do a greater amount of supervision, but it necessitates a new clerk. Occasionally, it is desirable to remove certain clerical details from departmental clerks or storekeepers and to carry them out in the production control office. Here again, there is no actual increase in work, but, initially, additional clerical help will be needed until the total workload can be readjusted. In cases where adequate records have not been maintained, an increase in clerical work is obvious,

but this is usually offset by a decrease in expediting requirements.

Where production control is being started from scratch with meager, or no, standard information, the production control manager must be very well acquainted with all operations in the shop. It will be necessary for him to shoulder a good part of the burden of process records preparation and development of time standards and other data.

Where standard information is well developed, or where an industrial engineer can take over this phase, the production control manager need not have such wide shop experience. He should be well acquainted with the use and application of standard information. He should be a man who can command respect from the foremen. At the same time he must be capable of withstanding sales pressure.

#### **Advantages Are Many**

1. A high percentage of on-time shipments. The actual performance will be related to management's investment in inventories and production facilities, the necessity for accepting short-delivery orders and the requirement for minimizing production costs. Acceptable performance probably will be somewhere between 75 and 95 per cent, or better, on-time shipment, depending on the business and operating characteristics.

2. Improved customer relations. A proper production control system will provide the customer with realistic shipment promises. Further, it will permit advice to the customer in advance of the shipment date if a serious shipping delay is to be incurred. This

point alone can create much good will, since a customer most times can accommodate a delay if he is told to expect it. On the other hand if he really has a serious problem, early advice gives the supplier a chance to take extraordinary steps if the order merits them. When the customers learn that a shipping promise means what it says, life becomes much more peaceful through elimination of expediting and unnecessary requests for status reports.

3. Better use of productive labor. By planning ahead on production, management can be advised of labor requirements and the needs to expand or contact the labor force or to schedule overtime. Through planning, it is possible to smooth out departmental loads and to avoid major swings in specialized labor requirements.

The introduction of production control may bring many production prob-

"For better use of productive labor. . . "



lems to light. For instance, an electrical parts manufacturer discovered that it was consistently pulling people from one department to handle rush orders in another. A transfer of two people smoothed out the work flow and improved shipments.

4. Better use of production facilities. As with labor, production control permits more economical use of facilities through scheduling the lowest number of new setups consistent with delivery requirements and through practical spreading of work to prohibit intermittent overloads or underloads. Proper scheduling can drastically reduce the breaks in production to "just get this order out for one of our best customers." A new production control system often points up many trouble spots in production where capacity is critically limited or where it is excessive.

5. Optimum inventory investment. Here is a major source of control that no management should overlook. An unplanned inventory may require many times the investment of one under effective control. When the investment in inventories is properly coordinated with sales and production, management will obtain the optimum use of a major investment.

A good deal of fortitude is required for general management to set up a production control system. A system implies policies. A reasonably administered system will produce results consistent with the policies on which it is based. General management then, through its policy formulation, is the backbone of production control. • • •



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Here Are Six Reasons Why

## Versatility And Efficiency Make Band Saws A Profitable Tool

### Part 3—Band Saw Blades

By **Darrell Ward**, Engineering Editor

■ Band sawing is a high-production, efficient and precise method of cutting stock, whether you are cutting off sections from bars and structural shapes or contour cutting a punch and die set from a block of tool steel.

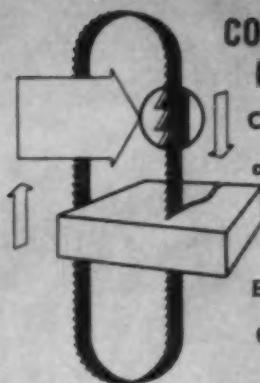
The band saw blade makes fewer and finer chips. It separates metal from metal far faster and more economically than any average cutting tool.

The band saw blade will cut many times faster and waste about half as much material in the form of chips as the hack saw blade required for the same cutting job. The band saw will waste a fourth or less compared with a circular type cold saw or slotting mill cutter.

Three obvious advantages of the band saw: speed, precision and small waste, are inherent in the nature of its operation.

The blade is a long band run over large wheels at fairly high speeds, speed being a significant feature because the section passing through a cut quickly dissipates its frictional heat as it travels its long path around and back again. Equivalent sfm speeds for hack saw blades would burn them up.

Since the blade runs in only one direction instead of back and forth, a band saw blade can be guided close to the work and be more precisely controlled along the



### CONTINUOUS CUTTING

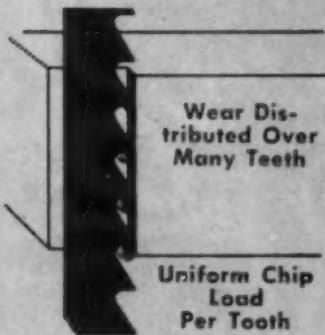
Chip Removal Is Fast and Accurate

Each Tooth a Precision Cutting Tool

### SIMPLE FIXTURING



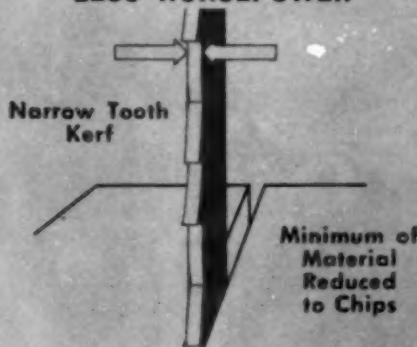
### HOLDS SHARPNESS



Wear Distributed Over Many Teeth

Uniform Chip Load Per Tooth

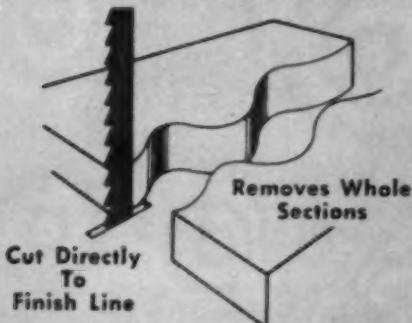
### LESS HORSEPOWER



Narrow Tooth Kerf

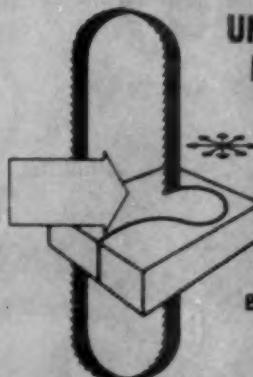
Minimum of Material Reduced to Chips

### LEAST MATERIAL WASTE



Cut Directly To Finish Line

Removes Whole Sections



### UNRESTRICTED MACHINING GEOMETRY

No Limitation on Angle, Direction or Length of Cut

Built-in Tool Holder

## SELECTION AND USE OF SAW BLADES continued

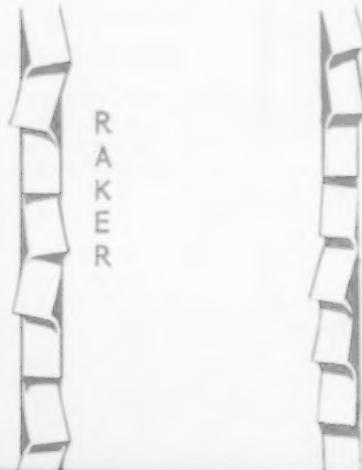
### *Three advantages of the band saw— speed, precision, and small waste*

cutting line. The blade also can utilize finer teeth for a given piece of work, therefore a finer surface finish can be maintained. It is common practice to cut directly to a line and then take off the remaining few thousandths by grinding to the finish required. Close tolerance high production slotting is done frequently with a band saw and wheel combination.

The band saw blade is small in section compared with a hack saw blade required for the same work, so the thin band saw obviously makes smaller and fewer chips for a given length or depth of cut.

The pertinent facts hold true for both basic types of band saw machines; the horizontal type used generally for simple cut off or the vertical which is adapted to every-

**BAND SAW BLADE TEETH** are commonly made with the teeth raker set or wavy set. The raker set teeth are preferred for general use and for cutting large solids or thick plates.



thing from simple cut off work to complex contour cutting of matched punch and die sets from the same block of tool steel. Machining geometry is essentially unrestricted with limitations on angle, direction or length of cut.

An outstanding feature of the vertical machine is that the downward traveling blade tends to hold the workpiece flat against the table surface. This permits free hand cutting directly to a finish line, or extremely simple fixturing when the workpiece must be more precisely guided into the blade.

#### **Select the Best Blade for the Job**

You can select the best blade for the job in band sawing just as you can for hack sawing but only if you have an understanding of the different types of blades and different tooth patterns made available for different purposes.

The principal factors you will need to know are the set of the teeth, the style of tooth pattern, the number of teeth per inch, the width of blade and the type of blade material.

#### **Two Principal Sets of Teeth**

Band saw blade teeth are commonly made with the teeth raker set or wavy set as already explained in the hack saw blade discussion. The raker set teeth would be preferred for general use and particularly for cutting large solids or thick plate. The raker set retains a uniform saw kerf and produces a fast cut-off rate.

The raker set is definitely indicated for contour cutting on the vertical type machine. You can cut out intricate shapes to layout line at close tolerance with this blade, working right to the line and leaving only enough material to remove the surface marks. A single grinding operation can bring ultimate precision and finish on the workpiece.

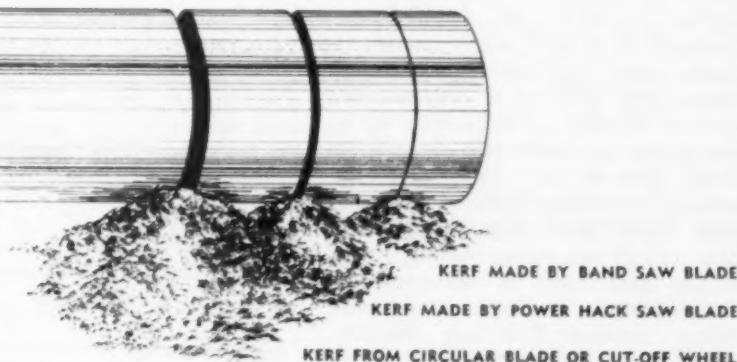
It is for this reason you will see die makers band sawing a matched pair of parts, a punch and mating die, directly from a block of tool steel. By sawing around the contour on a slight angle with the work table tilted, you can cut out the shape of the punch with the sides sloped outwardly. These can be ground later to produce substantial land and clearance with mating sides of the die after it also is ground. In this way, you produce a punch with relief angle on the top, away from the cutting face, and relief on the underside of

the die all in one simple cutting operation. This method of producing dies would be impractical without the benefit of a good quality, properly selected raker set blade.

You would select a wavy set blade to overcome damage to the teeth when cutting thin sections, structural shapes, tubing, pipes or sheet stock. The wavy set teeth make each successive tooth take a small increment of the total "bite" thereby relieving the full impact of the normally full-set tooth as it contacts the thinner workpiece. The wavy set blades come in nearly all sizes and run well on all machines, but are not generally recommended when the raker set blade is applicable to the job.

#### **Tooth Pattern Determines Purpose**

*Standard tooth saw blades*, with their well-rounded gullets, are best suited to cutting most all ferrous materials and the non-ferrous hard



**RELATIVE DIFFERENCE IN WASTE** from different methods of cutting can be important for dimensional tolerances and cost of high alloy materials. By using a band saw to cut flat slugs from a bar of titanium, for example, you can gain one half-inch-thick slug for every 8 you would otherwise cut with a power hack saw or 5 for every 16 slugs cut with a cold saw or cut-off wheel.

brasses and bronzes. You will find this your most useful tooth pattern in either the wavy set or the raker set.

*The skip tooth blade*, known by a number of other names in different brands, came as a needed development for greater gullet capacity without weakening the blade body. Greater gullet capacity means better chip clearance for soft materials. Therefore, this may be your best blade pattern for cutting aluminum, copper, magnesium, soft brasses, or any material which produces large, soft chips. Fast, smooth and economical cutting in plastics and wood is done with the skip tooth blade.

*The hook tooth blade* is another pattern known by different names. This one is essentially the same as a skip tooth, but while the skip tooth has a zero rake angle on the face or cutting edge of the tooth, the hook tooth blade is made with a 10° positive rake angle. The positive rake added to a basic skip tooth design provides two additional features: a better bite into soft material and better chip breaking to prevent soft, gummy materials from building up in the gullet. The better bite of the hook tooth permits clean chip removal without increasing frictional heat and with lighter feed pressure, therefore less power and faster cutting.

The hook tooth is recommended for non-ferrous and non-metallic materials, however it is very effective on ferrous castings and mild steels of thick cross section.

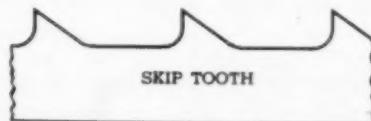
#### Number of Teeth Varies with Blades

Tooth pitch or the number of

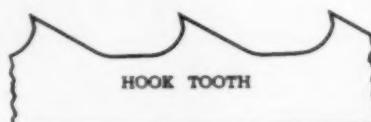
teeth per inch of blade ranges from 2, the coarsest to 32, the finest. But this will vary with different styles and types of blades. Not all pitches will be available in every kind of blade, so the familiar old three-tooth rule may require compromise in some cases. Whenever possible, at least three teeth must be in contact with the work and the ideal would be not more than six. Obviously, this rule cannot be followed in every instance



Standard tooth blades, with their well-rounded gullets, are usually best for most ferrous materials, hard brasses and bronzes.



Skip-tooth blades provide for more gullet and better chip clearance without weakening the blade body. This one is especially desirable for aluminum, copper, magnesium and soft brasses.



Hook-tooth blades offer two advantages over the skip-tooth blade: the 10° rake angle makes the blade feed easier and its chip breaker design prevents gumming up in the gullet. This blade will do more work at lower cost on essentially the same applications as the skip-tooth blade.

because the work or its shape may be such that it calls for a blade outside of the available ranges. And, it is not always practical to change

blades on a machine for every different piece of work.

The types and sizes of metal-cutting band saw blades recommended

Material Cost per Pound	Value of Material Removed For Various Kerfs (Per Square Inch of Cutting)					
	1/16" Kerf	3/32" Kerf	1/8" Kerf	1/4" Kerf	5/16" Kerf	1/2" Kerf
.01	\$0.0002	\$0.0003	\$0.0004	\$0.0008	\$0.0012	\$0.0016
.02	.0004	.0006	.0008	.0016	.0024	.0032
.03	.0005	.0008	.0010	.0020	.0030	.0040
.04	.0007	.0010	.0014	.0028	.0042	.0056
.05	.0009	.0014	.0018	.0036	.0054	.0072
.06	.0011	.0017	.0022	.0044	.0066	.0088
.07	.0012	.0018	.0024	.0048	.0072	.0096
.08	.0014	.0021	.0028	.0056	.0084	.0112
.09	.0016	.0024	.0032	.0064	.0096	.0128
.10	.0018	.0027	.0036	.0072	.0108	.0144
.11	.0020	.0030	.0040	.0080	.0120	.0156
.12	.0021	.0032	.0042	.0084	.0126	.0168
.13	.0023	.0035	.0046	.0092	.0138	.0184
.14	.0025	.0038	.0050	.0100	.0150	.0200
.15	.0027	.0041	.0054	.0108	.0162	.0216
.16	.0028	.0042	.0056	.0112	.0168	.0224
.17	.0030	.0045	.0060	.0120	.0180	.0240
.18	.0032	.0048	.0064	.0128	.0192	.0256
.19	.0034	.0051	.0068	.0136	.0204	.0272
.20	.0035	.0053	.0070	.0140	.0210	.0280
.30	.0053	.0079	.0106	.0212	.0318	.0424
.40	.0070	.0105	.0140	.0280	.0420	.0560
.50	.0088	.0132	.0176	.0352	.0528	.0704
.60	.0106	.0159	.0212	.0424	.0636	.0848
.70	.0124	.0186	.0248	.0496	.0744	.0992
.80	.0141	.0212	.0282	.0564	.0846	.1128
.90	.0159	.0239	.0318	.0636	.0954	.1272
1.00	.0177	.0266	.0354	.0708	.1062	.1416
1.50	.0265	.0398	.0530	.1060	.1590	.2120
2.00	.0350	.0525	.0700	.1400	.2100	.2600
2.50	.0438	.0657	.0876	.1752	.2628	.3504
3.00	.0530	.0795	.1060	.2120	.3180	.4240

Compute the area of the saw cut you want to make. Multiply this area by the value factor under the column of your saw blade width, reading across from column one on the line equivalent to your cost of the material. The result is your cost of waste material from the saw kerf.

### Band saw blade designs still are not standardized

for regular stock and for catalog publication are specified in the Simplified Practice Recommendation R214-55 published by the U. S. Dept. of Commerce.

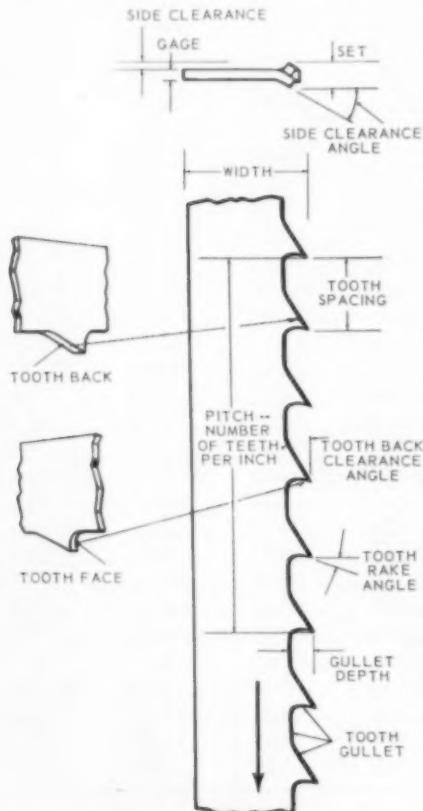
Width tolerance is plus 0.0", minus 0.0156" for finished blade measure-

ment. Thickness tolerance is plus-or-minus 0.001".

It is noted that while certain sizes and pitches of tooth are made available with both wavy set and raker set teeth, only wavy set is provided in any blades of 32-tooth pitch, for  $\frac{1}{2}$ " blades of 24 teeth, and for  $\frac{3}{4}$ " blades of 18 teeth.

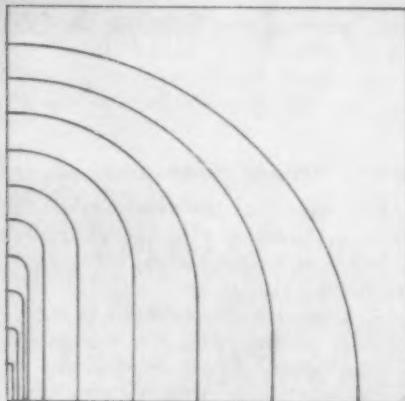
All other blades are available with raker set for regular type or standard tooth blades. Raker set or straight set is optional with the manufacturer of skip tooth blades. Set specification is not included for hook tooth blades, although most blade manufacturers appear to have standardized on raker set for these.

Some confusion to the blade buyer, particularly in the promotion literature published by blade manufacturers, comes from private brand names frequently of the "glamorous" type and sometimes of the descriptive type, which designate blades with names which lead to the assumption that it is above standard and unlike every other brand. This is understandable in view of the keen competition in the industry, but it can be misleading if you are not aware of the promotion effort demonstrated in the naming of a particular style of saw blade. As long as you realize what the blade is and what it will do for you, there is no need to be confused with brand name differences. Just don't be confused by a good salesman who comes along and says, "My zipper tooth, flair set, Venus alloy blade cuts faster and



Important factors of band saw blade geometry and common terminology.

## WHAT IS THE MINIMUM RADIUS YOU CAN CUT?



There is some variation in set width of teeth on different blades of the same blade width. There will be a further deviation resulting from slight wear on the sharp corners of the teeth after you begin using a blade. Therefore, you

will not always be able to cut to the low side of the minimum radius range. The following tabulations cover normal minimum radii and the range variations found among different blades and on the same blades with slight wear.

Always use the widest blade possible for the smallest radius you expect to cut.

Blade Width	Minimum Radius
1"	7-1/4" - 7-5/16"
3/4"	5-7/16" - 5-1/2"
5/8"	3-3/4" - 3-7/8"
1/2"	2-1/2" - 2-9/16"
3/8"	1-1/4" - 1-7/16"
1/4"	5/8" - 11/16"
3/16"	5/16" - 3/8"
1/8"	1/8" - 7/32"
3/32"	1/16" - 3/32"
1/16"	Sq. - 1/16"

lasts longer than anything on the market."

If that salesman spoke better English, he might be telling you that he sells a standard or regular tooth blade with raker set teeth set a little wider than others and the blade is made of high alloy, high speed steel. But, if the blade is the one you want and it will do a good job, you need not be confused by the dramatic name branding.

More serious confusion and much controversy among users can arise from another set of factors. The Simplified Practice Recommendations are established without uniformity in some of the characteristics of a blade. It is in this area that a blade manufacturer has much leeway in his particular methods and may actually

give you a better blade, or may only make a blade that looks somewhat different.

The *shape or conformation of teeth* is not standardized and may be made according to the single standard of the producer for each type, width and tooth pitch.

The *width of set* is another factor left up to the single standard of the producer and can vary to a dismaying degree. For example, in one line of blades you can cut a minimum radius of  $2\frac{1}{2}"$  with the  $\frac{1}{2}"$  wide blade. In another, a  $3"$  radius is minimum for the same size blade. And, only one company to our knowledge even commits itself to specifying the width of set within a given tolerance.

*Hardness*, as a final factor of con-

## SELECTION AND USE OF SAW BLADES continued

fusion in distinguishing between different makes of blades, is set by the single standard of the producer. Yet, this factor is standardized to a certain extent which is helpful. The recommendations state that blades are to be file-hard on the teeth, and the hardness is not to extend into the body of the blade more than  $1/32''$ . The Rockwell hardness midway between the bottom of the teeth (gullet) and the back edge of the blade is to be not more than 67 on the A scale.

With an understanding of these factors, both standardized and vari-

able, you can now examine the following charts for blades listed as normal stock merchandise to choose those most applicable to your needs.

### Select Proper Pitch

You can select the proper pitch of teeth in band saw blades basically the same as for hack saws, with minor variations. The three-tooth rule will apply when feasible, with six or eight teeth in contact with the workpiece as the ideal. Generally, choose a coarse pitch for large sections and soft metals, finer pitch for small

## REGULAR TYPE BAND SAWS

Width in inches	Thickness	Number of teeth per inch	
		Wavy set	Raker set
1/16	0.025	32	24
3/32	0.025	32	18
1/8	0.025	none	14, 18, 24
3/16	0.025	none	10, 14, 18
1/4	0.025	32	10, 14, 18, 24
3/8	0.025	none	8, 10, 14, 18
1/2	0.025	10, 14, 24	6, 10, 14, 18
5/8	0.032	10, 14	8, 10, 14, 18
3/4	0.032	8, 10, 14, 18	6, 8, 10, 14
1	0.035	10	6, 8, 10, 14

## SKIP-TOOTH BAND SAWS

Width in inches	Thickness	Number of teeth per inch
3/16	0.025	4
1/4	0.025	4, 6
3/8	0.025	3, 4
1/2	0.025	3, 4
3/4	0.032	3
1	0.035	2, 3

## HOOK-TOOTH BAND SAWS

Width in inches	Thickness	Number of teeth per inch
1/4	0.025	4, 6
3/8	0.025	3, 4, 6
1/2	0.025	2, 3, 4, 6
3/4	0.032	2, 3, 6
1	0.035	2, 3, 6



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## SELECTION AND USE OF SAW BLADES continued

### PITCH SELECTION CHART — BAND SAW BLADES

MACHINABILITY GROUP of MATERIAL	THIN SECTIONS $\frac{1}{8}$ " and UNDER	MEDIUM SECTIONS $\frac{1}{4}$ " to $\frac{11}{16}$ "	LARGE SECTIONS $\frac{11}{16}$ " and OVER
1 Easily Machined	14-18-24-32	10-12-14	6-8-10
2 Moderately Difficult to Machine	14-18-24-32	10-12-14	6-8-10
3 Difficult to Machine	14-18-24-32	10-12-14	6-8-10
4 Easily Machined Non-Ferrous	4-6 Skip, 6-8-10	3-4-6 Skip, 6-8	2-3-4 Skip

sections and harder metals. The following quick selector chart can serve as a general guide. Use the Material Selector Chart for specific steels with recommended tooth pitch, saw velocity and coolant.

#### Install the Blade Carefully

Before you can expect efficient results from your band saw, regardless of proper selection of blade and other factors, you must give careful attention to the proper installation of the blade on the machine.

Blades must be square and run true to the work table or vise and run true on the wheels. First, place the blade on the wheels and adjust the normal running position. Second, adjust the tension of the blade. Third, adjust the guides and bearings.

On any bandsaw with metal wheels, the blade should ride in a position where the teeth clear the wheel over the beveled edge or, on wheels designed to handle various widths of blade, run the blade against the flange and make sure the set of the teeth clear in the proper groove

on the wheel designed for this purpose. In any case, the sharp corners of the set teeth must not touch metal on the wheel.

On bandsaws with rubber tired wheels, there is no problem. You tilt the idler wheel one way or the other to make the blade run in a straight line from wheel to wheel and on the center or high point of the wheel tire tread. A secondary problem with rubber tires is that they collect chips and must be cleaned more frequently, and replaced once they are worn out of round.

#### How to Adjust Tension

One machine builder told us that about eight out of every ten machines are set up with improper blade tension. Either they do not have enough tension and the result is a tremendous waste of blades, or the tension is too great which results in early blade fatigue or early failure in wheels and bearings.

On a horizontal machine, insert the blade in the roller guides before applying tension. Then bring up the

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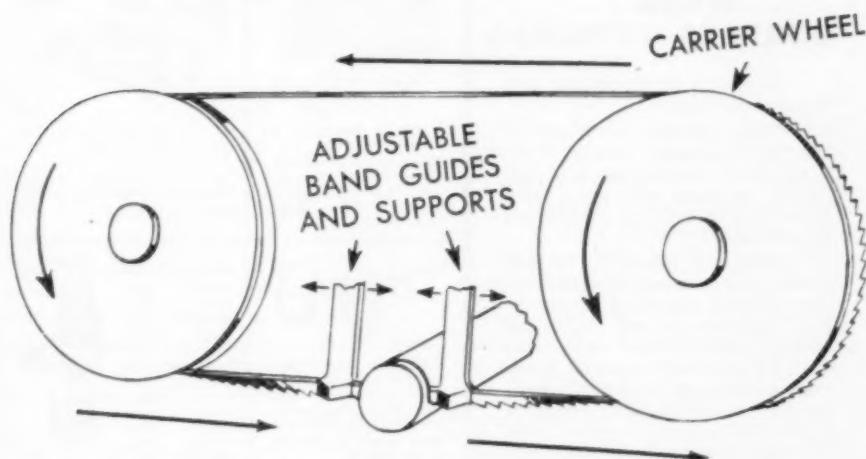
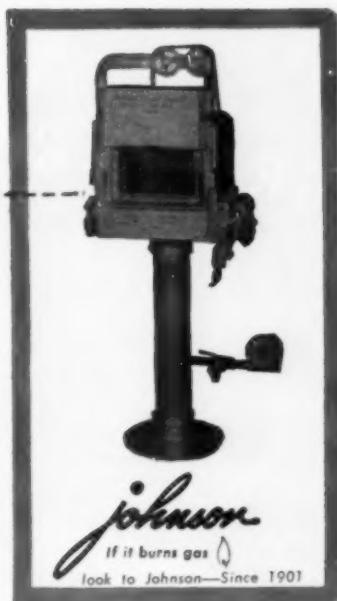


Diagram of operating principle of the horizontal type machine used as a cut-off band saw. The blade rides over wheel rims with its back against the wheel flanges. Blade guides twist the blade into proper cutting position in the work area. See text for proper adjustment of guides and supports.

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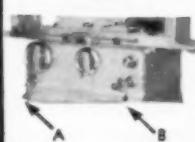
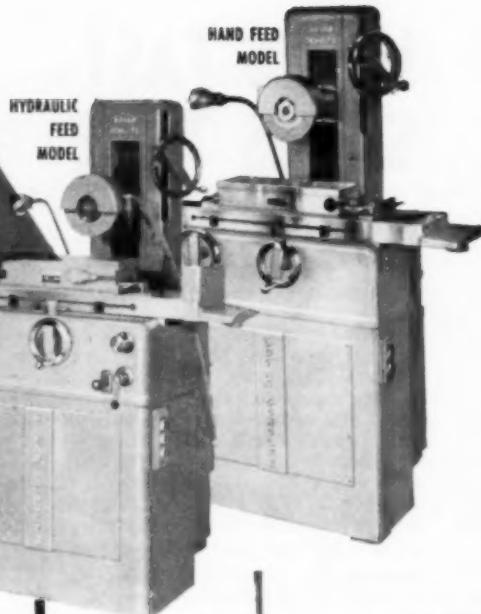
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### ***Care is essential when setting roller guides***

tension just enough to eliminate the slack in the blade. Now check to see that the back edge of the blade is running just against the wheel flanges and not riding over them.

If the blade is running true you can complete the tensioning as recommended by your machine manufacturer. One general recommendation suggested was to remove the slack, then rotate the tension adjustment one more full turn. This method was claimed to be better than any of the more complex devices designed to measure the correct tension. You may wish to try this for its practical advantages. The method can apply to both horizontal and vertical machines, although another method suggested for vertical machines is to pull up enough tension so that the blade, half way between the wheels and free of the guides, can be flexed about  $\frac{1}{2}$ " with the fingers, somewhat similar to the popular method of adjusting tension on "V" belts.

#### **How to Adjust Alignment on Horizontal Machines**

The roller guides twist the blade 45° for straight cutting. Therefore, you must check for blade straightness between both sets of guides with the blade under full tension. The guides adjust for alignment both vertically and horizontally.

To obtain good blade alignment, the fixed vise face must be square with the bed of the machine. Use a square for checking both alignments, but make sure you do not let the metal tool come in contact with any

of the sharp corners of the saw teeth.

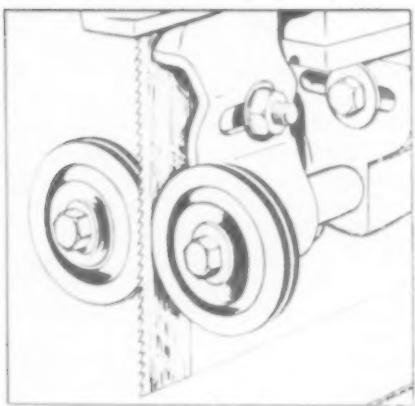
Check your vertical alignment across the width of the horizontal blade by placing the square on the machine bed with the edge of the square making contact on both edges of the blade. To avoid contact with the sharp edge of a tooth, you must place the square at a tooth set to the opposite side. Make this check near each of the guides to make certain there is no twist along the cutting length.

Check your horizontal alignment along the cutting length of the blade by placing the square on the fixed vise face with the square edge touching the body of the blade. Do not press the square edge against the blade; merely bring it up into contact and look for daylight between any portion of the square and the saw blade.

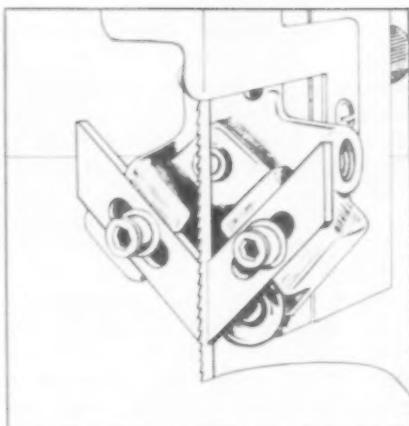
It is extremely important for you to make your guide adjustments exactly to zero in on both vertical and horizontal alignment of the blade. If you don't, either through unnecessary haste or carelessness, you cannot obtain a true cut nor will your blade give optimum service.

There must be no binding of the blade by the side roller guides. These guides are brought up into firm contact with the blade, but they still can be rotated by hand. Leave a very slight clearance between the back edge of the blade and the back roller bearing when the machine is running freely. Contact is made when pressure is exerted on the blade by the work.

## SELECTION AND USE OF SAW BLADES continued



ROLLER TYPE SIDE GUIDES



BLOCK OR INSERT TYPE  
SIDE GUIDES

### Adjust Everything to the Blade

One machine builder pointed out the necessity of realizing that you do not make your adjustments arbitrarily to distort the blade into a position you think you want. Band saws are so built that when the wheels are carrying the blade properly, the blade is true and everything else is brought into alignment with the blade.

His explanation is that the roller guide holder assemblies or guide arms that are placed on all machines in the field usually have the adjustment primarily for the final movement in manufacturing and secondarily for replacement of parts that may be broken or worn out. They are never used for the realignment of a blade to overcome blade dullness or similar defects which produce runout in the saw cut. This seems to be a common misunderstanding.

The blade has its true up and down travel. The roller guides are utilized only to twist the blade into position so that the back edge will follow the cutting edge through the cut.

It is important to remember that everything on the machine must be adjusted to the blade for correct cutting. This includes the vise jaws, too.

### Wavy Set Not for Horizontal Machines

Strong emphasis has been placed on one problem which seems to plague the industry through ignorance. We have been told that many blade manufacturers offer wavy set blades for use on horizontal band saws as a cure-all in certain problem cases. The result is a great loss of efficiency and accuracy. It was pointed out that many wavy set blades, with the waves set high in the blade, will ride a zig-zag course through the guide rollers in modern

machines. This puts abnormal stress on the peaks of the waves in contact with the rollers and creates a series of fatigue spots in addition to making an irregular cut through the work-piece.

While a wavy set blade may be stronger than a raker set and the gradual bite of wavy set teeth relieves the impact stress to make the blade last longer in some cases, or cut thinner material than otherwise possible, there are other factors to remember for horizontal bandsaws. First, a wavy set blade may be unnecessarily damaged between the rollers. Second, it may not cut true. Third, the wavy set blade takes a larger kerf than raker set blades and, therefore, may require greater horsepower on the machine to obtain efficient production. Keep these facts in mind when you are ready to adjust alignment on your horizontal band saw.

#### How to Adjust a Vertical Blade

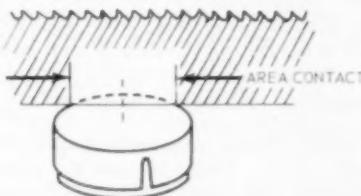
Loosen and move your blade guides completely free of contact with the blade when you install a blade on the vertical or contour type band saw. If the wheels are rubber-tired, adjust the idler to make the blade run centered on the crown. Apply enough tension to remove the slack. Revolve the wheels by hand to see that the blade runs true.

When you are merely changing blades of the same specifications, you will find the back of the blade barely clearing contact with the back up or rear bearing. But, if you are installing a completely different kind of blade, you may have to readjust the rear bearing to a new position where it will not touch the blade but have

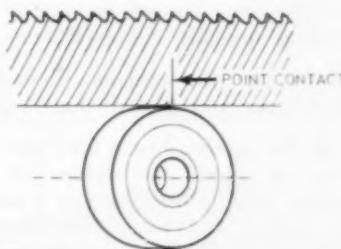
near contact. Here, again, heed the warning about adjusting everything to the blade after the blade is true on the wheels.

Apply full tension. Check to see that the side guides have full bearing on the body of the blade but do not overlap the gullets of the teeth. The outer edge or face of the side guides or rollers must be set behind the gullets enough so that a slight finger pressure against the blade will make the gullets ride behind the outer edge of the guides.

Usually it is better to adjust the set of guides below the table before adjusting those above. Bring the inside guide up into contact with the blade first, but do not apply enough



Thrust type rear bearing rotates in a plane at right angles to the blade, offers considerable area of "back up" support, but generates a significant amount of friction.



Roller type bearing provides most friction-free movement, but offers only point contact support to back of saw blade.

## BAND SAW BLADES continued

pressure to deflect the blade sideways. Make only a "kiss" contact. If your machine employs solid block or insert guides, put a piece of thin paper, such as letterhead or typing paper, between the body of the blade and the outer guide. Bring the outer guide up into firm contact against the paper. Use no more pressure than that which will allow you to pull out the piece of paper after the guide is locked in place. The clearance the paper leaves will be just enough for a free running blade but still close enough for proper guiding.

If your machine has roller type guides, bring the outer roller up to firm contact against the blade without the paper shim. Make the contact firm, but not binding. You must be able to rotate the rollers by hand after they are locked in place.

Apply finger pressure against the teeth of the blade to see if cutting pressure will cause the blade to ride against the rear bearing. Release to see that the blade and rear bearing do not touch when the blade is free of pressure on thrust type rear bearing. For a machine with roller type rear bearing, the adjustment is the same as for side guide rollers.

Now, run the machine to confirm the checks you already have made.

As the machine runs idle, you will want to check the action of the welded joint in the blade as it passes the guides and rear bearings. The band must neither bind between the guides nor jump as it passes the rear bearings.

Continued on page 144

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## SELECTION AND USE OF SAW BLADES continued

CUTTING SPEEDS and FEED PRESSURES  
for BAND SAW MACHINES

MACHINABILITY RATING OF METAL BEING CUT	BLADE SPEEDS		RECOMMENDED FEED PRESSURE
	MACHINES WITH SET SPEEDS	MACHINES WITH VARIABLE SPEEDS—FPM	
Group 1—Easily Machined	FAST	110-160	MEDIUM LIGHT
Group 2—Moderately Difficult to Machine	MEDIUM	90-100	MEDIUM
Group 3—Difficult to Machine	SLOW	40-80	MEDIUM HEAVY
Group 4—Easily Machined Non-Ferrous	FAST	150-4000	MEDIUM LIGHT

## Watch your Speed and Feed

You can select the optimum blade speed and feed pressure for each different job. Here, again, we have general recommendations which serve only as a relative guide for a quick appraisal of the job requirements. And, there is more specific information for specific jobs in the Material Selector Chart.

Blade speed is an important factor. If it is too fast for the material being cut, the teeth are not allowed sufficient time to dig into the material. They merely rub on the surface, create friction, and dull the cutting edges. Blades run too slow, of course, are inefficiently operated.

The different types of feed, hand, hydraulic and mechanical, are all highly variable in the pressure they exert. Too many factors are involved to make tabulated data practical on feed or pressure. As a general rule, however, an even pressure without forcing the work gives best results. Avoid forcing the work at the start

because you may shorten the blade life and produce a bad cut. Use moderate feed pressure to cut straight and accurate.

You will know you are feeding with too much pressure if the machine chatters or vibrates.

Study the chips under a glass when necessary. Fine, powdery chips indicate a feed rate which is too light. The teeth are mostly rubbing over the surface instead of cutting.

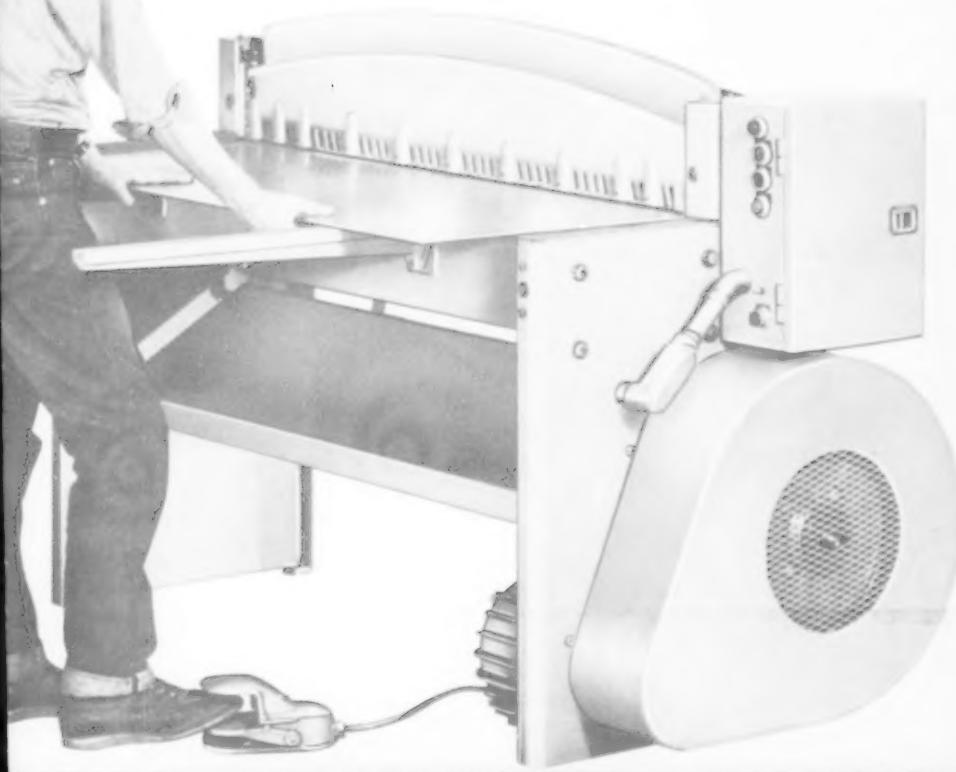
Burned chips will tell you that you are feeding with excess pressure or, perhaps, excessive blade speed. This will cause the teeth to chip or break out as the blade overheats.

A free curl is what you want. This comes only with ideal feed pressure and will give you the fastest cutting time with the longest blade life.

As a starting point in judging your feed and speed, you can approach the optimum combination from the following chart of speeds and feed pressures.

continued to page 166

new di-acro power shear no. 48  
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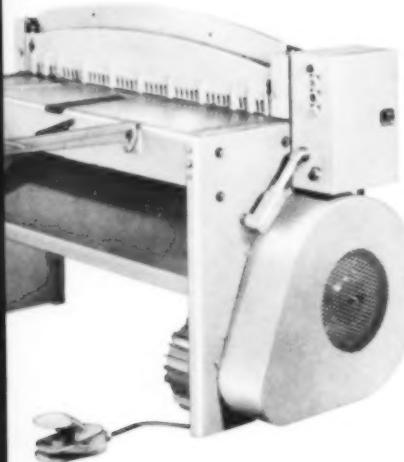
14-gauge capacity, 50-inch length . . . cuts all shearable sheet materials with die accuracy  
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READ ALL ABOUT IT . . . new Di-Acro Power Shear No. 48



# new di-acro power shear no. 48



14 ga. cap.  
50 in. length  
up to  
160 s.p.m.\*  
cycling

\*Strokes Per Minute

The all new No. 48 Di-Acro Power Shear represents a break through in precision production shearing. It has a high-torque, high-slip totally enclosed motor that drives a flywheel with a built-in self-adjusting electric clutch. Matched triple V-belt drive is quiet, gearless. Because the electric clutch engages instantly without pausing for pins, splines, or valves, the No. 48 shears speeds up to 160 strokes per minute on single cycling . . . ideal for use in conveyor and run-out lines. Adjustable cam operated brake engages only at the top of the stroke — no drag to wear out linings and absorb power.

Standard equipment includes a micrometer operated ball bearing back gauge graduated in .001". It is ruled to indicate  $\frac{1}{16}$ " and can be angled for special jobs. Back gauge has double bracket. An optional front operated control includes a counter with direct readings in both inches and thousandths.



Inclined ram of the No. 48 Shear keeps only the blade edge in contact with material to be sheared. The angle of the blade counteracts thrust and keeps the blade straight increasing both accuracy and efficiency of the shearing force. It also permits the use of easy to grind, straight sided blades which can be rotated to use all four edges.

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Capacity of this new shear is 14 gauge mild steel over the full 50-inch cutting width. Standard equipment includes motor, step-down transformer (provides 110 current to controls for safety's sake), automatic hold-

down, micrometer operated back gauge, front gauge bar and brackets, six squaring gauges, reversible protrac gauge, one set of alloy tool steel four-edged blades, and a movable foot treadle — all for \$2,750. For complete information consult the yellow pages of your phone book under Machinery: Machine Tools for the name of your nearest distributor, or send in the postcard on the next page.



# di-acro shears include...

In addition to the new No. 48, the line of Di-Acro shears includes hand and power operated shears in cutting widths from 6" to 36". Quik-Set micrometer gauges are standard equipment on all models—automatic hold-down bars are standard on all but the smallest. For any use from model shop to production line, Di-Acro Precision Shears can be relied upon for fast, accurate results—their extra quality gives extra years of service.



36" Di-Acro Shear  
No. 36



6" Di-Acro Shear No. 1

TURN  
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O'NEIL IRWIN MANUFACTURING COMPANY  
314 Eighth Avenue, Lake City, Minnesota

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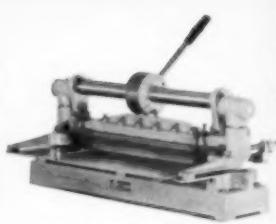
**O'NEIL-IRWIN MFG. CO.**  
314 EIGHTH AVENUE, LAKE CITY, MINNESOTA



DI-ACRO SHEAR NO. 1 with Quik-Set Micrometer Gauge — 6" shearing width (overdriven type).



DI-ACRO SHEAR NO. 3 with Quik-Set Micrometer Gauge and Material Hold-Down Bar — 12" shearing width (overdriven type).



DI-ACRO SHEAR NO. 4 with Quik-Set Micrometer gauge and Material Hold-Down Bar — 24" shearing width (overdriven type).

choose from 7 great di-acro shear  
including the new no. 48!



DI-ACRO SHEAR NO. 36 with Quik-Set Micrometer Gauge and Material Hold-Down Bar — 36" shearing width (underdriven type).



DI-ACRO STANDARD POWER SHEAR NO. 24 with motor, controls, Quik-Set Micrometer gauge and Material Hold-Down Bar — 24" shearing width — to 90 strokes/minute (overdriven type).



DI-ACRO VARI-O-SPEED POWER SHEAR NO. 24 with motor, controls, Quik-Set Micrometer gauge and Material Hold-Down Bar — 24" shearing width — 30-150 strokes/minute (overdriven type).

Please send me additional information on the Di-Acro Shears I have checked below:

Di-Acro Shear No. 1    Di-Acro Shear No. 3    Di-Acro Shear No. 4    Di-Acro Shear No. 36  
 Di-Acro Power Shear No. 24    Di-Acro Vari-O-Speed Power Shear No. 24  
 Di-Acro Power Shear No. 48

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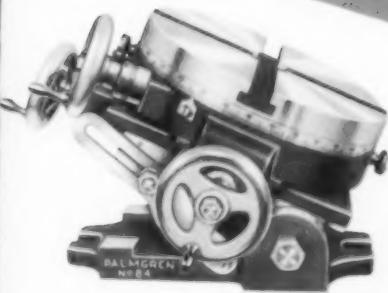
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Also, please put me on your free mailing list to receive the DI-ACRO NEWSLETTER on time saving, cost cutting techniques in action for industry.

# PALMGREN

## PRODUCTS



ROTARY  
AND INDEXING  
TABLES



ANGLE  
VISSES

USED IN ALL INDUSTRIES . . . EVERYWHERE

# PALMGREN

## DRILL

Nos. 5, 6, 10, 20 and 30



No. 10 Drill Press Vise  
Grooved Cast Jaws



No. 20 Drill Press Vise  
Plain Steel Jaws



No. 30 Drill Press Vise  
Grooved Steel Jaws



No. 5 Drill Press Vise  
Plain Steel Jaws



No. 6 Drill Press Vise  
Grooved Steel Jaws

These handy Drill Press Vises are designed for small articles or pieces when drilling. Ideal for toolrooms, machine shops, experimental rooms, school shops, home or repair shops. They are accurately machined from the best castings. The adjusting screws are made of steel with a fine pitch thread and long bearing in vise body. Made in several sizes, they are equipped with steel jaws, plain or grooved horizontally and vertically for holding round pieces.

Vise No.	Width Jaws	Depth Jaws	Opening Jaws	Length Overall	Weight	Net Price
5	1 1/2"	1"	1 5/8"	5 1/8"	2 lbs.	7.85
6	1 1/2"	1"	1 5/8"	5 1/8"	2 lbs.	7.95
10	2 7/16"	1 1/2"	3"	7 1/2"	5 1/2 lbs.	8.75
20	2 7/16"	1 1/2"	2 3/8"	7 1/8"	6 lbs.	8.85
30	2 7/16"	1 1/2"	2 1/2"	7 1/4"	6 lbs.	8.95

# FOR PRODUCTION-TOOLING-MAINTENANCE

## PRESS VISES

### No. 13

The PALMGREEN No. 13 DRILL PRESS VISE is machined on all sides and may be turned on either side, end, or upside down for special operations. It is recommended for use on drill presses, milling machines, grinders and other machines.

This Vise has removable steel jaw plates, and a  $\frac{5}{8}$ " Acme thread adjusting screw. Machined slots are provided on either side on the Vise to aid in clamping Vise to machine table. Accurately machined of semi-steel grey iron castings.



Vise No.	Wght. Jaws	Depth Jaws	Open'g Jaws	Lgth. Ov'll	Width Ov'll	Hgt. Ov'll	Net Wght.	Net Price
13	3"	1 $\frac{3}{4}$ "	3"	7 $\frac{1}{2}$ "	3"	3"	11 lbs.	16.95

### No. 14

A medium size, sturdy drill press vise with 4" jaw width, opening to full 4 inches, the No. 14 vise is precision built for heavy duty service, such as Milling, Drilling, and Grinding. It is accurately machined, and the Acme thread adjusting screw has long bearing in body. Removable ground steel jaw plates are provided, one of which is V-grooved horizontally and vertically.



Vise	Width Jaws	Depth Jaws	Open'g Jaws	Lgth. Ov'll	Hght. Ov'll	Wght.	Net Price
14	4"	1 $\frac{3}{4}$ "	4"	10 $\frac{3}{4}$ "	3 $\frac{1}{4}$ "	17 $\frac{1}{2}$ lbs.	21.95

# PALMGREN

## ANGLE

for Production-Tooling Maintenance



No. 0 Angle Vise  
Cast Grooved Jaws



No. 00 Angle Vise  
Plain Steel Jaws



No. 000 Angle Vise  
Grooved Steel Jaws



No. X0 Angle Vise  
Plain Steel Jaws



No. X1 Angle Vise  
Grooved Steel Jaws

Vises shown on this page are essentially for Drill Press, Milling Machine, Grinder and Bench Work. Accurate set-ups are quickly made without the use of clamps, wedges or make-shift methods.

PALMGREN Angle Vises can be adjusted to full 90 degrees or used like ordinary vises when horizontal. Accurately graduated for all angles and ready for instant use by locking adjustable support screws.

All parts are accurately machined of high quality materials. Adjusting screw has fine pitch thread and long bearing in vise body.

Vise No.	Width Jaws	Depth Jaws	Open-ing Jaws	Over-all Length	Kind of Jaws	Weight Vise Only	Net Price
X0	1 1/2"	1"	1 1/2"	6 5/8"	Plain Steel	4 lbs.	9.85
X1	1 1/2"	1"	1 1/2"	6 5/8"	Grooved Steel	4 lbs.	9.95
0	2 1/2"	1 1/2"	2 1/2"	9"	Grooved	9 lbs.	11.75
00	2 1/2"	1 1/2"	2 1/2"	8 7/8"	Plain Steel	10 lbs.	11.85
000	2 1/2"	1 1/2"	2 1/2"	9"	Grooved Steel	10 lbs.	11.95

# USED IN ALL INDUSTRIES . . . EVERYWHERE

## VISES

### Angle Vises with Swivel Bases

#### VISES and "M" BASES

Vise No.	Base No.	Price Vise and Base	Price Base Only
X0	15M	13.80	3.95
X1	15M	13.90	3.95
0	25M	16.70	4.95
00	25M	16.80	4.95
000	25M	16.90	4.95



No. 000 Angle Vise  
Mounted on  
Model 25M Swivel Base

#### VISES and "B" BASES

Vise No.	Base No.	Price Vise and Base	Price Base Only
X0	15B	13.80	3.95
X1	15B	13.90	3.95
0	25B	16.70	4.95
00	25B	16.80	4.95
000	25B	16.90	4.95



No. 000 Angle Vise  
Mounted on  
Model 25B Bench Base

#### VISES and "C" BASES

Vise No.	Base No.	Price Vise and Base	Price Base Only
X0	15C	13.80	3.95
X1	15C	13.90	3.95
0	25C	16.70	4.95
00	25C	16.80	4.95
000	25C	16.90	4.95



No. 000 Angle Vise  
Mounted on  
Model 25C Clamp Base

# PALMGREEN

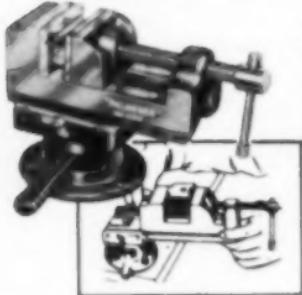
## GENERAL DRILL PRESS VISES



Handy general purpose vises that every shop needs. Highly recommended for use on drill presses, milling machines, grinders and many other machines. They have strong fine thread adjusting screws, steel jaws grooved for convenience in holding round pieces. Lugs are provided on sides for bolting vises to machine table.

Vise No.	Width Jaws	Depth Jaws	Opening Jaws	Length Overall	Height Overall	Weight Lbs.	Net Price
120	1 1/2"	1"	1 1/2"	4 1/2"	1 3/4"	3	8.95
320	3"	1 1/2"	3"	8"	2 3/4"	8	11.95

## Nos. 12 and 18 BENCH—DRILL PRESS VISES



Here's a handy vise that can be used on bench or drill press without removing work from the vise. The vise body is square all around and can be used on either side, one end, or in horizontal position. The vise may be locked in position in the adapter by tightening thumb screw which forces a steel gib against the vise dovetail. The vise and adapter assembly can be rotated and locked in any position.

Vise No.	Width Jaws	Depth Jaws	Opening Jaws	Kind of Jaws	Weight	Net Price
12	2 1/2"	1"	2 1/2"	Plain-Grooved	11 lbs.	19.95
18	4"	1 3/4"	4"	Plain-Grooved	29 lbs.	29.95

# FOR PRODUCTION-TOOLING-MAINTENANCE

## No. 23 B AND No. 24 B ANGLE VISES

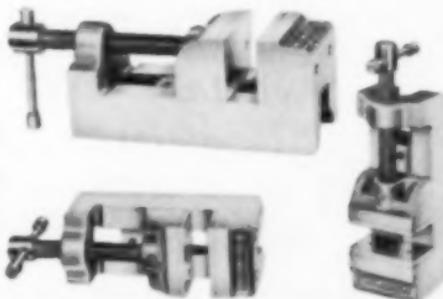
A rugged Angle Vise for quick, accurate angle setups for milling, drilling, grinding and also for checking and laying out work. Graduated and quickly adjusted to any angle and stays locked under the most severe service. This Vise is extremely useful for toolroom or production work — eliminating hours in making jigs and fixtures. It can be used as an ordinary Drill Press or Milling Machine Vise when lowered to horizontal position.



Vise No.	Width Jaws	Depth Jaws	Opening Jaws	Length Overall	Height Overall	Weight with Base	Net Price
23B	3"	1 3/4"	3"	12"	5 1/4"	22 lbs.	32.95
24B	4"	1 3/4"	4"	12 3/4"	5 5/8"	36 lbs.	39.95

## No. 11 AND No. 22 GRINDING VISES

These Vises are accurately ground on sides, bottom, ends, and top. Have ground steel removable jaw plates. Made of high cast iron. Ideal for grinding small pieces on magnetic chucks.



Vise No.	Width Jaws	Depth Jaws	Open Jaws	Length Overall	Weight	Price
11	1 1/2"	1"	1 5/8"	5 1/8"	2 lbs.	24.95
22	2 17/16"	1 1/2"	2 1/2"	7 1/4"	6 lbs.	34.95

# PALMGREN

## CROSS SLIDE MILLING TABLES



The Palmgren No. 192 Cross Slide Milling Table is designed for Milling and Grinding. The No. 192 has a center keyway  $\frac{1}{8}'' \times \frac{5}{8}''$  and two "T" slots  $\frac{5}{8}'' \times 1\frac{1}{4}''$ . An extra "T" slot is provided on front vertical side of the work table. The Table is equipped with stops for both cross feeds. Large, easy to read dials are graduated in thousandths. The longitudinal travel is 11", and cross feed is  $6\frac{1}{2}''$ . The base of the table is  $7\frac{3}{4}'' \times 10\frac{3}{4}''$ . Flanges located at the corners of base for mounting on machines or special fixtures. Both cross slides have gib for adjustment and take up for wear.

No.	Table Length	Table Width	Height Overall	Dials	Table Top Key-way	Table T-Slots	Wgt. Lbs.	Net Price
192	18"	9 $\frac{5}{8}$ "	4 $\frac{1}{2}$ "	2 $\frac{7}{8}$ "	$\frac{5}{8}''$	$\frac{5}{8}''$	112	249.95

## AUXILIARY LEVER FEED MILLING TABLE



Converts your screw feed milling machine to a hand feed production job in minutes.

No.	Table Length	Table Width	Height Overall	Table Travel	Top T-Slot	Base Key-way	Weight Lbs.	Net Price
191	14"	4"	2 $\frac{3}{4}$ "	6"	$\frac{7}{16}''$	$\frac{1}{2}''$	36	169.95

USED IN ALL INDUSTRIES . . . EVERYWHERE



No. 246  
Angle Plate

ADJUSTABLE ANGLE PLATES  
with or without  
Swivel Bases

Mounted on  
Swivel Base



Angle Plates are extremely useful for work that cannot be held conveniently in a Vise. Slots are provided in the Angle Plate top for holding work for drilling, milling, grinding, layout, and inspection. Angle Plates can be used with or without Swivel Base. The Angle Plate is graduated for angle setups and the Swivel Base is graduated full 360°.

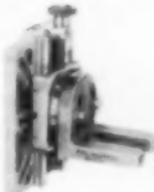
Vise No.	Top Size	Base Length	Height Plate and Base	Plate Only			Plate with Base	
				Wgt. Lbs.	Net Price	Plate No.	Wgt. Lbs.	Net Price
246	6" x 6"	8"	4 5/8"	9	16.95	246B	12	21.95
249	9" x 9"	12 1/2"	6 3/4"	29	34.95	249B	35	42.95

MILLING ATTACHMENTS FOR ENGINE LATHES

Palmgren Milling Attachments for engine lathes will enable you to mill slots, keyways, grooves, flats, squares; also drilling, sawing and grinding at any angle. Fits any lathe that has a tool post. Set up in 10 seconds.



No. 400P



No. 400P



No. 250P

No.	Fits Tool Post up to	Plate Size	Weight Lbs.	Net Price
250P	1 1/4"	6" x 6"	13	34.95
400P	2"	9" x 9"	22	44.95

# PALMGREN

## MACHINE VISSES



These Machine Vises are accurately machined and constructed for hard usage. They are made of the best materials obtainable and are guaranteed against defective material and workmanship. These Vises have ground steel jaws — one jaw has vertical and horizontal grooves for convenience in holding round pieces — one plain jaw. Designed for use on Milling Machines, Grinders, Drill Presses and Tapping Machines. Vises have acme thread adjusting screws. Furnished complete with 360° graduated Swivel Base. With two  $\frac{5}{8}$ " keys and screws for base to fit machine table slots.

Vise No.	Width Jaws	Opening Jaws	Depth Jaws	Length Overall	Height Overall	Weight with Base	Net Price with Base
310	3"	3"	1 1/2"	9"	3 3/4"	11 lbs.	39.95
410	4"	4"	1 3/4"	11 3/4"	4 5/8"	22 lbs.	49.95
610	6"	6"	2"	14 1/2"	5 3/4"	50 lbs.	69.95

## No. 73 AIR VISE



The Palmgren No. 73 Air Vise, with 4" Jaws, is designed for all types of machining operations: light, medium, or heavy duty. Quick, easy set-ups for production milling, drilling, grinding, tapping, sawing and assembly. Foot pedal operation leaves both hands free to load and unload with speed.



Vise is supplied complete with foot pedal, air hose and fittings. Ground steel jaw plates are provided, one of which is V-grooved horizontally and vertically for holding round work. Can be easily removed to accommodate special jigs and fixtures.

Vise No.	Width Jaws	Opening Jaws	Depth Jaws	Length Overall	Weight	Net Price
73	3"	3"	1 3/4"	13"	29 lbs.	49.95

# FOR PRODUCTION-TOOLING-MAINTENANCE



## NO. 55 ALL ANGLE VISE for Grinding, Drilling and Milling

The PALMAGREN No. 55 ALL ANGLE VISE provides a quick, easy set-up for any machining operation that requires a simple or compound angle. Difficult angle milling, drilling, grinding, reaming and checking operations may be performed with an absolute minimum of time required for set-up. Work is held rigidly and Vise can be securely locked in any position.

Vise No.	Width Jaws	Opening Jaws	Depth Jaws	Top Angle	Base Length	Weight Lbs.	Net Price
55	2 1/2"	2 1/2"	1 1/2"	90°	6"	18	34.95

## No. 7 UTILITY VISE

This is a sturdy, compact Vise, designed for easy set-ups which would ordinarily require costly jigs and fixtures. Milling, drilling, and grinding are but a few jobs that can be done with this Vise. The movable jaw is grooved vertically for holding work. The Vise is low-built — only 2 1/2" overall height. The heavy steel adjusting screw has a coarse pitch acme thread for fast action. Three bolt lugs are located on the vise base for mounting on the machine table.



Vise No.	Width Jaws	Opening Jaws	Depth Jaws	Weight	Net Price
7	3 1/2"	4"	1 3/4"	13 lbs.	16.95

## No. 15 ALUMINUM HAND VISE

Indispensable for holding small pieces when drilling, grinding, and polishing.



Vise No.	Width Jaws	Opening Jaws	Length Over-all	Wgt.	Net Price
15	1 1/2"	1"	5"	7 oz.	2.95

# PALMGREN

## MILLING ATTACHMENTS For Use on Engine Lathes

Just A Few Operations  
You Can Do On  
Your Lathe!



T-Slotting



End Milling



External Dovetail



End Mill Angle Cut



Cutting Keyways



No. 250 Milling Attachment

Recommended for 8" and 10" Lathes.



No. 400 Milling Attachment

Recommended for 12", 14" and 16" Lathes.



No. 150 Milling Attachment

Recommended for 4" and 6" Lathes.

Straddle tool post



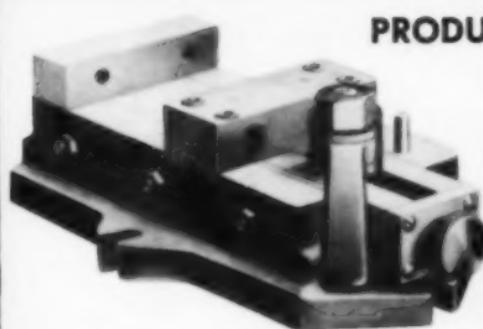
## CONVERTS YOUR LATHE FOR MILLING IN 10 SECONDS

PALMGREN Milling Attachments for engine lathes will enable you to do hundreds of milling operations on your lathe. You can mill slots, keyways, grooves, flats, squares, hexagons, octagons, external and internal dovetails, sawing, grinding and drilling at any angle.

The Milling Attachment is quickly and easily set up on your Lathe in 10 seconds. To set up on your Lathe, remove the tool post ring around the "U" shaped base angle bracket and the Milling Attachment straddles the tool post and is bolted down just like an ordinary tool holder. Vertical adjustment has graduated collar in thousandths. Graduated for vertical rotation to any angle. Fits South Bend, Atlas, Logan, Sheldon, Craftsman, and other Lathes. Thousands now in use by all industries. Vise has grooved jaw for holding round pieces. Recommended for use on all kinds of material, production work as well as tool-room, laboratory and hobby work.

Nos.	Fits Tool Post Up To	Width Jaws	Jaws Open	Depth Jaws	Weight	Net Price
150	1 in dia.	1 1/2"	1 5/8"	1"	4 1/2 lbs.	21.95
250	1 1/4 in dia.	2 1/2"	2 1/2"	1 1/2"	11 1/2 lbs.	29.95
400	2 in dia.	4"	4"	1 3/4"	36 lbs.	39.95

# USED IN ALL INDUSTRIES . . . EVERYWHERE



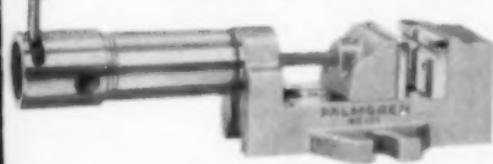
## PRODUCTION VISES

Extremely rugged vise designed for fast production work. Has adjustable cam locking lever which locks with speed—and even surface pressure. Movable jaw is quickly adjusted to various size pieces. Has adjustable wear plates to take up side wear. Lugs are provided on both sides and ends for

secure bolting to machine table. Plain steel jaws are furnished, but customer usually makes special jaws to suit their own requirements for irregular size and shaped pieces. All movable parts are hardened to give long service. With two 11/16" keys and screws for base to fit machine table slots. Dimensional print will be supplied upon request.

Vise No.	Width Jaws	Depth Jaws	Opening Jaws	Weight	Net Price
33	3"	1 1/4"	4"	29 lbs.	79.95
44	4"	1 3/8"	4 1/2"	41 lbs.	99.95
66	6"	1 3/4"	6 1/2"	97 lbs.	174.50
88	8"	2"	8 1/2"	167 lbs.	269.00

## No. 121 AIR VISE



Designed for light drilling, milling, tapping and assembly, this vise is equipped with 1-1/8" dia. stainless steel air cylinder with adjustable stroke. Air cylinder and valve are combined in one compact unit.

No.	Width Jaws	Depth Jaws	Opening Jaws	Height Overall	Length Overall	Weight Lbs.	Net Price
121	1 1/2"	1"	1 1/2"	1 3/4"	8"	4	24.95

# PALMGREN

## HEAVY DUTY MACHINE VISSES



Palmgren 40B, 60B, and 80B Heavy Duty Vises are built for production, tooling, and maintenance. The jaw opening of each vise equals or exceeds the jaw width; removable steel jaw plates are machined and ground.

The flanged base on each vise provides a deep coolant trough which drains at front and back. Four bolt lugs, as well as a keyway and keys, are furnished on the vise base. The swivel base is equipped with 2 bolt lugs, as well as a keyway and keys. The Acme thread adjusting screw is equipped with replaceable screw bushing and collar. Each vise may be used with or without the 360° graduated swivel base. An adjustable brass pointer is located on the vise base to provide for quick, accurate degree setting.

Vise No.	Width Jaws	Opening Jaws	Depth Jaws	Vise with Swivel Base		Vise No.	Vise Only	
				Weight	Net Price		Weight	Net Price
40B	4"	4"	1½"	44 lbs.	89.95	40	34 lbs.	69.95
60B	6"	6"	2"	101 lbs.	119.95	60	77 lbs.	89.95
80B	8"	8"	2¼"	165 lbs.	199.95	80	140 lbs.	169.95
No. 6 Crank Handle for 4" Vise (extra) Wt. 1½ lbs. ....								
No. 10 Crank Handle for 6" Vise (extra) Wt. 2 lbs. ....								
No. 14 Crank Handle for 8" Vise (extra) Wt. 2½ lbs. ....								

# FOR PRODUCTION-TOOLING-MAINTENANCE



## HEAVY DUTY ANGLE VISES

Palmgren 2B, 3B and 4B Vises are made for Milling, Drilling, Grinding, and Laying Out and Checking Work. The jaw opening equals or exceeds the jaw width, and the removable jaw plates are machined and ground. The extra heavy Acme thread adjusting screw is provided with a removable screw bushing. Each Vise can be used with or without the swivel base. In the lowered position the Vise can be used as an

ordinary machine vise. The vise base is furnished with 4 bolt lugs and two 11/16" keyways with keys for machine mounting. Two bolt lugs and keyways are provided on the swivel base.

Vise No.	Width Jaws	Opening Jaws	Depth Jaws	Vise with Swivel Base		Vise No.	Vise Only	
				Weight	Net Price		Weight	Net Price
2B	4"	4"	1 1/2"	59 lbs.	134.95	2	49 lbs.	110.95
3B	6"	6"	2"	130 lbs.	229.95	3	115 lbs.	199.95
4B	8"	8"	2 1/4"	231 lbs.	279.95	4	190 lbs.	239.95

## NEW "LOW BOY" SWIVEL MACHINE VISES

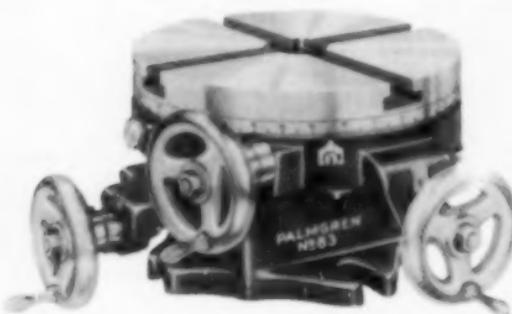


are designed for Milling, Drilling, Shaping, Grinding and all operations that require a rugged holding device where overall height is critical. Can be used with or without swivel base and vise body as well as base can be mounted to machine table.

Vise No.	Width Jaws	Opening Jaws	Depth Jaws	Vise with Swivel Base		Vise No.	Vise only	
				Weight Lbs.	Net Price		Weight Lbs.	Net Price
325B	3 1/4"	3"	1 1/8"	13 1/4	44.95	325	9 1/2	37.95
425B	4 1/2"	4"	1 1/4"	21	54.95	425	15 1/2	45.95

# PALMGREN

## No. 83 ROTARY TABLE WITH CROSS SLIDES



Two Cross Feed Slides  
and Rotary Feed  
Converts your Drill Press  
for vertical milling

The No. 83 Table is designed for use on drill press, milling machine, grinder, or shaper. It provides compound slides as well as rotary feed in one compact unit. Cross feed screws are 1/2" Acme thread, and provide transverse and longitudinal travel of 4-1/4". Cross feed dials are 1" diameter, graduated in thousandths of an inch. The rotary feed dial is 1-3/4" diameter, and is calibrated in 3 minute intervals.

Rotary feed is positive and worm gear ratio is 40:1. Take-up adjustment is also provided for wear in worm and gear.

The base provides a long bearing for the dovetail slide.

The No. 346 Palmgren Indexing Attachment can be quickly attached to the rotary feed shaft.

No.	Table Diameter	Height Overall	Top Graduations	Base Diameter	Base Bolt Centers
83	8"	5 1/8"	360°	6 1/2" x 7 1/2"	5 1/2" x 6 1/2"

No.	Gear Ratio	Table T-Slots	Base Keyway	Weight	Net Price
83	40-1	5/8"	5/8"	35 lbs.	79.95

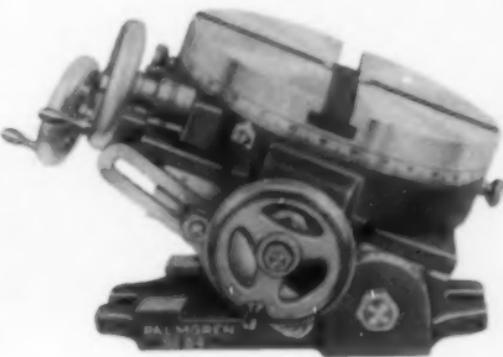
# USED IN ALL INDUSTRIES . . . EVERYWHERE

## No. 84 TILTING INDEXING AND ROTARY TABLE



No. 346 INDEXING ATTACHMENT for use with No. 83, 84 and 86 Tables. Two 2 5/8" Dia. Plates, each with 3 sets of holes. Plate One has 36, 30, and 24 holes. Plate Two has 40, 35, and 25 holes.

Price 39.95



The No. 84 Table is an extremely versatile tool that incorporates the rotary and dual cross feeds of the No. 83 with the new Palmgren 0° to 90° adjustable tilting feature. This universal Table is ideal for all angle Milling, Grinding, Shaping, Tapping, and Drilling operations, as well as layout work.

The Table top is 8" diameter and two 5/8" x 1" x 5/16" T-slots cross at center. The center is bored 1-5/8" diameter to depth of T-slot for centering plug.

Rotary feed is positive and worm gear ratio is 40:1. The worm and gear may be adjusted for wear. The rotary dial is 1-3/4" diameter, calibrated in 3 minute intervals.

The No. 346 Palmgren Indexing Attachment can be quickly attached to the rotary feed shaft.

No.	Table Diameter	Height Overall	Top Graduations	Length Base Dia.	Width Base Dia.
84	8"	5-11/16"	360°	9 3/4"	5"

No.	Length Base Bolt Centers	Gear Ratio	Table T-Slots	Base Keyway	Weight	Net Price
84	8"	40-1	5/8"	5/8"	41 lbs.	139.50

# PALMGREN

## No. 82 CROSS SLIDE MILLING TABLE



Designed for use on  
Milling Machines, Drill  
Presses and Grinders

The No. 82 Table has an 8" diameter top that can be turned freely 360° and secured in any position by tightening two lock clamps with knurled thumb screws. Center of Table top is bored to depth of T-slot for 1-5/8" locating plug. The Table top is also guaranteed 360°. T-slots are 5/8" x 1" x 5/16" for keys. Both dovetailed cross slides are furnished with adjustable gibbs to compensate for wear, and assure ease of travel to suit operation and material. Cross slide screws are 1/2" Acme thread with take-up adjustments for backlash. Dials are 1" diameter, graduated in thousandths. Cross slides are at right angles and maximum travel of each is 4-1/4". The base is 6-1/2" x 7-1/2" and provides long bearing for the dovetailed slide. The base has 5/8" keyways and keys for machine slot mounting.

No.	Table Diameter	Height Overall	Top Graduations	Base Diameter	Base Bolt Centers
82	8"	5 1/8"	360°	6 1/2" x 7 1/2"	5 1/2" x 6 1/2"

No.	Dials	Base Keyway	Table T-Slots	Weight	Net Price
82	1"	5/8"	5/8"	31 lbs.	64.95

# FOR PRODUCTION-TOOLING-MAINTENANCE



## No. 86 ROTARY TABLE



**No. 346 INDEXING ATTACHMENT** for use with No. 83, 84 and 86 Tables. Two 2 5/8" Dia. Plates, each with 3 sets of holes. Plate One has 36, 30, and 24 holes. Plate Two has 40, 35, and 25 holes.

Price 39.95

The No. 86 Table is ideal on jobs in which overall height of work is critical. Many operations require a vertical fixture, which takes up too much of the limited distance between spindle and machine table. Only 3 1/4" high, the No. 86 Rotary Table provides the answer to these problem jobs.

The top diameter is 8", and two 5/8" x 1" x 5/16" T-slots cross at center. The center of top is bored 1 5/8" diameter to depth of T-slot for centering plug. The top is graduated 360°, and worm-gear ratio is 40:1 with positive rotary feed. The worm and gear may be adjusted for wear. The rotary dial is calibrated in 3 minute intervals. Base keyway is 5/8" and keys and screws are provided for machine-slot mounting. The No. 346 Palmgren Indexing Attachment may be quickly attached to the rotary feed shaft.

No.	Table Diameter	Height Overall	Top Graduations	Base Diameter	Base Bolt Centers
86	8"	3 1/4"	360°	9 1/4"	10 1/2"

No.	Dial	Gear Ratio	Table T-Slots	Base Keyway	Weight	Net Price
86	1 3/4"	40-1	5/8"	5/8"	28 lbs.	69.95

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**HIGH-SPEED STEEL BLADES  
MATERIAL SELECTOR CHART**

R=Regular or standard tooth   S=Skip-tooth   H=Hook-tooth  
W=Water soluble coolant   SU=Highly sulphurized cutting oil

Material	Tooth pitch for work thickness				Blade velocity for work thickness				Coolant suggested	
	1/2"	1"	3"	8"	1/2"	1"	3"	8"	Contour saw	Power saw
Carbon Steels										
1015 to 1035	10R	8R	6R	3H	350	350	350	300	W	W
1065 to 1095	10R	8R	6R	3H	200	200	200	160	W	W
Manganese Steels										
1320 to 1345	10R	8R	6R	3H	150	150	150	100	W	W
Nickel Steels										
2317	10R	8R	6R	3H	175	175	175	140	W	W
2330 to 2345	10R	8R	6R	3H	150	150	150	100	W	W
Nickel-Chrome Steels										
3115 to 3130	10R	8R	6R	3H	175	175	175	140	W	W
3135 to 3150	10R	8R	6R	3H	175	175	175	140	W	W
Molybdenum Steels										
4017 to 4042	10R	6R	6R	3H	190	190	190	150	W	W
4047 to 4068	10R	8R	6R	3H	175	175	175	140	W	W
Chrome-Molybdenum Steels										
4130 to 4150	10R	8R	6R	3H	160	160	160	125	W	W
Nickel-Chrome-Moly Steels										
4317 to 4340	10R	8R	6R	3H	160	160	160	125	W	W
8615 to 8750	10R	8R	6R	3H	180	180	180	145	W	W
9310 to 9850	10R	8R	6R	3H	180	180	180	145	W	W
Nickel-Molybdenum Steels										
4608 to 4621	10R	8R	6R	3H	175	175	175	140	W	W
4640 to 4821	10R	8R	6R	3H	175	175	175	140	W	W
Chromium Steels										
5045 to 5160	10R	8R	6R	3H	175	175	175	140	W	W
50100 to 52100	10R	8R	6R	3H	80	80	80	60	W	W
Chrome-Vanadium Steels										
6117 to 6120	10R	8R	6R	3H	225	225	180	145	W	W
6145 to 6152	10R	8R	6R	3H	200	200	170	135	W	W
Silicon Steels										
9250 to 9260	10R	8R	6R	3H	165	165	165	125	W	W
9261 to 9262	10R	8R	6R	3H	165	165	165	125	W	W
High-Speed Tool Steels										
T-1, T-2	10R	8R	6R	3H	130	130	100	90	W	W
T-6, T-8	10R	8R	6R	3H	130	130	100	90	W	W
M-2, M-3	10R	8R	6R	3H	100	100	85	70	W	W
M-10	10R	8R	6R	3H	90	90	70	55	W	W
Die Steel (Air & Oil Hardening)										
D-7	10R	8R	6R	3S	90	90	70	55	none	none
O-1, O-2	10R	8R	6R	3S	210	210	200	180	W	W
Carbon Tool Steel (Water Hardening)										
W-1, Extra, Special, Regular	10R	8R	6R	3S	220	220	200	180	W	W
Stainless Steels										
302, 304	10R	8R	6R	3H	80	80	80	60	W	SU
303, 416	10R	8R	6R	3H	170	150	130	110	W	SU
316, 420	10R	8R	6R	3H	85	85	85	60	W	SU
321, 347	10R	8R	6R	3H	85	85	85	60	W	SU
430, 446	10R	8R	6R	3H	85	85	85	60	W	SU
440F, 443	10R	8R	6R	3H	130	130	120	100	W	SU

**CARBON STEEL BLADES  
MATERIAL SELECTOR CHART**

R—Regular or standard tooth  
W—Water soluble coolant

S—Skip tooth

H—Hook tooth

SH—Highly sulfurized cutting oil

Material	Tooth pitch for work thickness				Blade velocity for work thickness				Coolant suggested	
	1/2"	1"	3"	8"	1/2"	1"	3"	8"	Contour saw	Power saw
Carbon steel										
1015 to 1035	10R	8R	4H	3H	175	175	150	150	W	W
1065 to 1095	10R	8R	4H	3H	125	100	80	80	W	W
Manganese Steels										
1320 to 1345	10R	8R	4H	3H	125	100	80	70	W	W
Nickel Steels										
2317	10R	10R	4H	3H	100	90	75	75	W	W
2330 to 2345	10R	8R	4H	3H	100	90	75	75	W	W
Nickel-Chrome Steels										
3115 to 3130	10R	8R	4H	3H	100	90	75	75	W	W
3135 to 3150	10R	8R	4H	3H	140	90	65	65	W	W
Molybdenum Steels										
4017 to 4042	10R	4H	4H	3H	135	125	110	100	W	W
4047 to 4068	10R	8R	4H	3H	125	100	75	75	W	W
Chrome-Molybdenum Steels										
4130 to 4150	10R	8R	4H	3H	100	75	50	50	W	W
Nickel-Chrome-Moly Steels										
4317 to 4340	10R	8R	4H	3H	100	75	50	50	W	W
8615 to 8750	10R	8R	4H	3H	90	65	50	50	W	W
9310 to 9850	10R	8R	4H	3H	80	50	50	50	W	W
Nickel-Molybdenum Steels										
4608 to 4621	10R	8R	4H	3H	100	75	50	50	W	W
4640 to 4821	10R	8R	4H	3H	100	75	50	50	W	W
Chromium Steels										
5045 to 5160	10R	8R	4H	3H	100	75	50	40	W	W
50100 to 52100	10R	8R	4H	3H	125	100	50	50	W	W
Chrome-Vanadium Steels										
6117 to 6120	10R	10R	4H	JH	100	75	50	40	W	W
6145 to 6152	10R	10R	4H	3H	100	75	50	40	W	W
Silicon Steels										
9255 to 9260	10R	8R	4H	3H	125	100	50	50	W	W
9261 to 9262	10R	8R	4H	3H	125	100	50	50	W	W
High Speed Tool Steels										
T-1, T-2	10R	8R	4H	3H	90	70	50	50	W	W
T-6, T-8	10R	8R	4H	3H	90	70	50	50	W	W
M-2, M-3	10R	8R	4H	3H	80	60	40	40	W	W
M-10	10R	8R	4H	3H	75	55	35	35	W	W
Die Steel (Air & Oil Hardening)										
D-7	10R	8R	4S	3S	50	50	50	50	none	none
D-1, D-2	10R	8R	3S	3S	125	100	80	70	W	W
Carbon Tool Steel (Water Hardening)										
W-1, Extra, Special, Regular	10R	8R	4S	3S	125	100	80	70	W	W
Stainless Steels										
303, 416	10R	8R	4H	3H	100	80	60	60	W	W
440F, 443	10R	8R	4H	3H	120	120	100	70	W	W
Copper Base Alloys										
Manganese Bronze	10R	8R	4S	3S	900	600	400	200	W	W
Silicon Bronze	10R	8R	4S	3S	900	600	400	200	W	W
Phosphor Bronze	10R	3S	3S	3S	700	500	400	300	W	W
Aluminum Bronze	10R	8R	4S	3S	700	700	700	700	W	W
Beryllium Copper	10R	4S	3S	3S	2000	1600	1200	800	W	W

### HIGH-SPEED STEEL BLADES MATERIAL SELECTOR CHART

R=Regular or standard tooth S=Skip-tooth  
W=Water soluble coolant SU=Highly sulfurized cutting oil

Material	Tooth pitch for work thickness				Blade velocity for work thickness				Coolant suggested	
	1/2"	1"	3"	6"	1/2"	1"	3"	6"	Contour saw	Power saw
<b>Copper Base Alloys</b>										
Phosphor Bronze	10R	6R	4S	3S	700	500	400	300	W	W
Aluminum Bronze	10R	8R	6R	3S	700	500	400	300	W	W
<b>Nickel Base Alloys</b>										
Monel, "KR" Monel, Inconel	10R	8R	6R	3H	80	80	80	60	W	SU
"R" Monel	10R	8R	6R	3H	80	80	80	60	W	SU
"K" Monel, Inconel "X"	10R	8R	6R	3H	80	80	80	60	W	SU
Hastalloy "A"	10R	8R	6R	3H	120	120	120	75	W	SU
Hastalloy "B"	10R	8R	6R	3H	100	100	100	75	W	SU
Hastalloy "C"	10R	8R	6R	3H	90	90	90	60	W	SU
<b>Titanium Alloys</b>										
RC-130-B	10R	8R	6R	3H	110	110	110	75	W	SU
Ti-140-A, Ti-150-A, Pure 99% Ti	10R	8R	6R	3H	90	90	90	60	W	SU
MST-6AL-4V	10R	8R	6R	3H	100	100	100	70	W	SU

#### How to Obtain Optimum Cutting

You will naturally obtain optimum cutting by using the right pitch and type of blade and the correct speed for a specific material. While the previous charts serve as guides to general operations, you will benefit more from the foregoing charts especially in production work when a considerable volume of material is being cut, or on heavy material.

The charts show optimum selections and settings for both carbon steel blades and for high-speed steel blades. Although there is some correlation between high speed steel and the speed of operation, manufacturers have asked us specifically to point out the fact that even if you use a high speed steel blade you do not automatically rev up your machine to hog off material. High speed steel merely means that the blade will not

over-heat and break down until it reaches a much higher temperature above that which would break down the ordinary carbon steel blade. The HSS blade will withstand greater feed pressures and higher running speeds, but it also requires blade guides to be in better condition and perfectly adjusted.

The author wishes to thank the following companies for their cooperation in contributing material for this article: Victor Saw Works, Inc., Middletown, N.Y.; W. O. Barnes Co., Inc., Detroit, Mich.; The L. S. Starrett Company, Athol, Mass.; Diamond Saw Works, Inc., Chaffee, N.Y.; W. F. Wells & Sons, Three Rivers, Mich.; The Tannevitz Works, Grand Rapids, Mich.; Wardwell Manufacturing Co., Cleveland, Ohio; Roll-In Saw Company, Parma, Mich.; Kalamazoo Tank & Silo Company, Kalamazoo, Mich.; The DoAll Company, Des Plaines, Ill.; Nicholson File Company, Providence, R.I.; The Capewell Manufacturing Co., Hartford, Conn.; Clemson Bros., Inc., Middletown, N.Y.; The Henry G. Thompson & Son Co., New Haven, Conn.; Ladish Company, Cudahy, Wis.; Simonds Saw and Steel Co., Fitchburg, Mass.; H. K. Porter Co., Inc., Disston Division, Philadelphia, Pa.

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CINCINNATI, OHIO

Flywheel design typical of those produced for a Caterpillar engine produced at their Peoria plant. They're made of cast iron.



An example where . . .

## Multi-Purpose Machines Supplement The Multiples

*Varying hole patterns  
for Caterpillar's many flywheels  
quickly handled by  
multi-purpose machines in the line*

By **Carl Christian**  
Application Engineer  
The Foote-Burt Company  
Cleveland, Ohio

■ Ultra-sophisticated machine tools are making a tremendous impact on industrial plants and production methods, and unquestionably, they will continue to bring even further changes. But they will never completely do away with the old reliable work horses of the machine shop—the drill press, lathe, or milling machine.

Even in high volume plants equipped with the latest automatic machine tools, there is usually an important role for the multi-purpose machine.

The economics behind it is this: Highly engineered machines, such as multiple-spindle machines and transfer machines, are extremely specialized. They're designed to do a specific job. In order to justify their cost, they must almost always be used on long runs and repetitive operations. But they have limited versatility. The more an operation changes, the less economical they become. While tooling changes are possible, they're expensive on multiple-spindle machines. The more tooling changes, the higher the machining costs. Thus the sophisticated machine tools may sometimes actually increase costs instead of decreasing them.

Here is where the multi-purpose drill press, lathe, or milling machine shines. It's versatile. It's relatively inexpensive. It excels at short runs and frequent tooling changes. Because of these characteristics, it is, for instance, an ideal supplementary tool for the multiple. By taking away the odd-and-end operations which would waste the capabilities of the larger machines, it can make the difference between profit and loss to a line on which it is but only a dwarf part.



Costs at Caterpillar are kept low because production lines are not excessively automated as they would be if these flywheel holes were drilling on multiple-spindle machines.

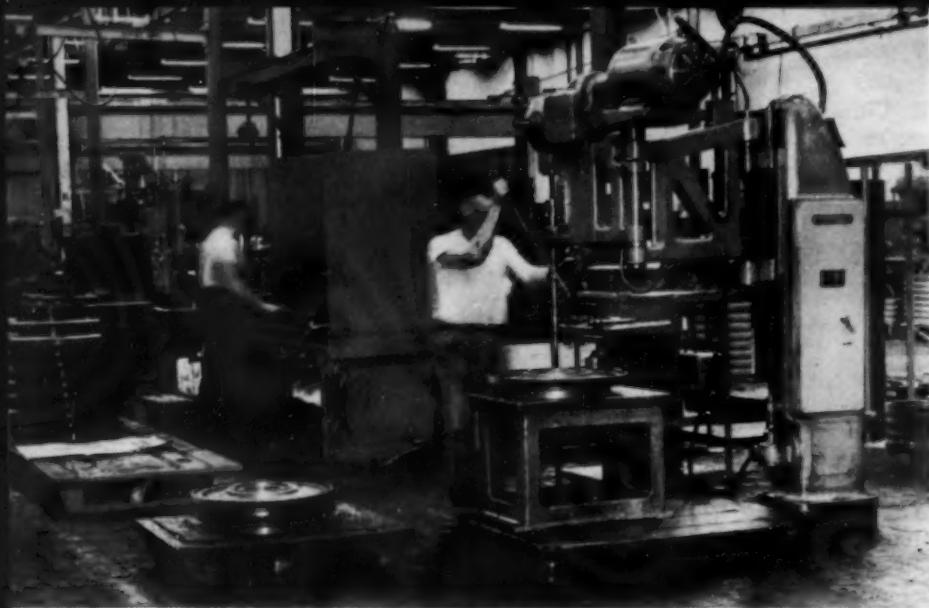
#### The Caterpillar Example

Take the case of Caterpillar Tractor Co., Peoria, Ill. This company makes crawler-type and wheel-type tractors, road machinery, and off-the-road specialized vehicles.

In physical size and volume of production, Caterpillar's several plants rank with the major automobile manufacturers. In machinery and equipment, it outranks many of them.

Caterpillar believes in both the modern, high-volume multiple-spindle machine tools and the less complicated, low-volume, multi-purpose ones. Typical of how they supplement each other, Caterpillar uses both kinds, almost side by side, on the flywheel line in its engine plant.

Here is a case in which the multiple-spindle machines cannot do



Two views of the flywheel line at Caterpillar's Peoria engine plant. Beginning of the line is at the far right in the photograph on the opposing page where a pair of turret lathes first face and bore the rough castings. Next, a multiple-spindle drilling machine where all holes are drilled that are common to all flywheel models.

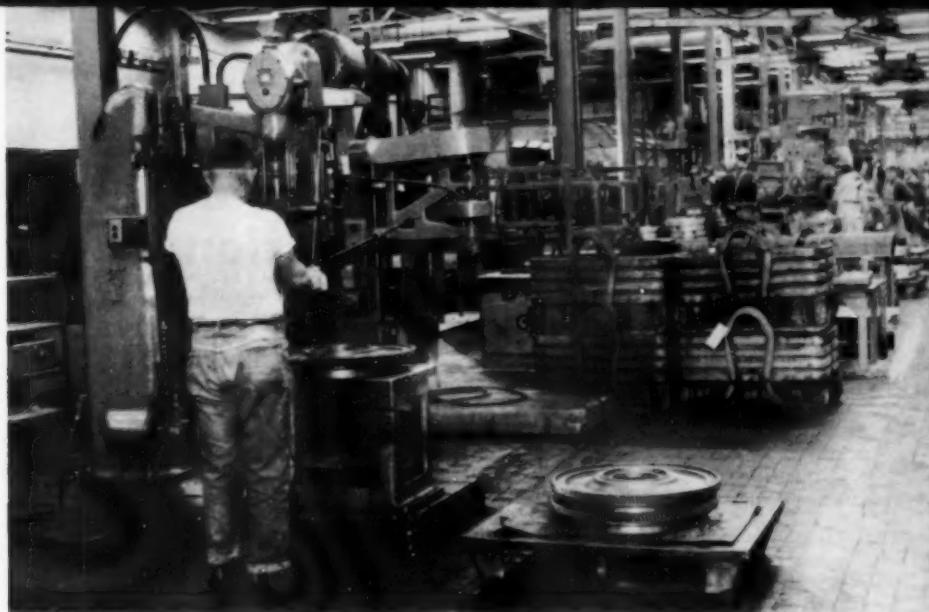
#### MULTI-PURPOSE MACHINES continued

all the operations; they would run costs prohibitively high if they tried. Caterpillar engineers designed the flywheel line so that it could produce flywheels for all engine models, since many operations are the same on all flywheels. Yet, there are many different holes, depending on the model to drill. The volume and type of operation is high enough to justify multiple-spindle drills. But to drill all these holes on the multiples would have meant retooling the entire complex set-up with every run. That would have skyrocketed machining costs. The logical answer was to drill on the multiples only those holes that are common to all models. That is what Caterpillar engineers decided to do.

All remaining holes (and there are only a few) are picked up by a multi-purpose radial drilling machine.

#### How It Works

The machine Caterpillar uses for drilling these odd holes is a Type G Footburt-Hammond sensitive radial drilling machine. It's designed for drilling, reaming, tapping, and similar operations. This machine is unlike most other radials in the method of positioning the head. Instead of the usual lead screw or rack-and-pinion drive for horizontal movement, it has an arm with an elbow joint at the middle. The head is fastened permanently to this arm, and the operator moves it horizontally simply by a



Sensitive radial drilling machine in the foreground of this and photograph on opposing page drills and taps miscellaneous holes not done on multiple-spindle machine. Note the hinged elbow that enables the operator to position the head at random without turning gears.

push of his hand. The hinge swings on stationary trunnions on the saddle, with the weight carried on ball thrust bearings. To further increase its versatility, the manufacturer was asked to install anti-friction bearings.

Here's how Caterpillar set up the operating sequence on the flywheel line in its engine plant:

The first operation on the cast-iron parts is the machining of the face and bore on a pair of turret lathes. Then a vertical gear shaper cuts the internal clutch teeth. Next, the multiple-spindle drilling machine drills the bolt holes common to all models. Following this operation, Caterpillar uses the radial drilling machine to drill and tap miscellaneous holes. These are

the holes that vary from model to model. Now the ring gear is shrunk and bolted to the flywheel, and the radial drilling machine is again used to drill miscellaneous holes. Following this, all bolts and lock nuts are assembled, and the flywheel is ready for dynamic balancing.

#### **Versatility**

The Footburt Type G radial drilling machine has the versatility Caterpillar needs for this operation. The head can cover an area in a radius as far as 50" from the saddle trunnions, or come in as close as 15".

This combination of multiple-spindle and single-spindle drilling gives Caterpillar the combination of speed and economy it needs. • • •

# You can Adapt BOKOE

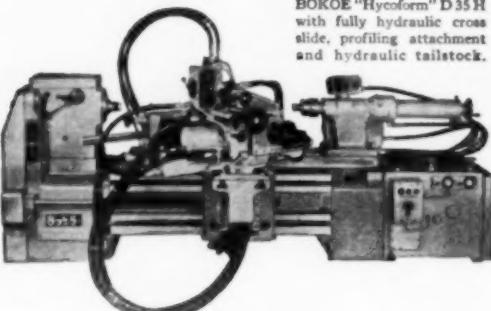
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with built-in copying attachment  
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BOKOE Light Spinning Lathe  
D 35 L with hand rest  
and mechanical tailstock.



BOKOE "Hycosform" D 35 H  
with fully hydraulic cross  
slide, profiling attachment  
and hydraulic tailstock.

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- Mechanical, hydro-mechanical  
or fully hydraulic cross-slide
- Front only or combined front & rear cross-slides
- Mechanical or fully hydraulic tailstock
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- Automatic cycle control

There's a BOKOE machine for every type of spinning and flow forming operation—for light and heavy work on ferrous and non-ferrous materials—for cylindrical and conical shapes and nose cones used in aircraft and missile applications.

- Flow forming of Aluminum up to  $\frac{1}{8}$ " thickness
- Flow forming of soft steel up to  $\frac{1}{4}$ " thickness
- Swing up to 86" maximum
- Longitudinal slide movement of 40"



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# field reports

10



Ten micro-inch finish on hard-faced bottle mold plungers is achieved by this LeBlond Dual Drive lathe equipped with LeBlond tracer and constant surface speed control.

## CONSTANT SPEED TURNING YIELDS 10 MICRO-INCH FINISH

■ At Overmyer Mould Co. in Winchester, Ind., a turning frontier has been crossed. Overmyer is contour-turning 58 R<sub>c</sub> material to a 10 micro-inch finish on a production basis. Such a finish on such hard material, when achieved at all, is commonly associated with secondary polishing operations. Overmyer is able to use the finely turned parts—plungers for glass bottle molds—just as they come from the lathe.

Actually, Overmyer has two lathes, side-by-side, equipped to do this job. Both are LeBlond 15" Dual-Drives, with LeBlond tracers and Eaton Dynamatic constant speed drive controls. Although not large lathes, the LeBlond Dual-Drives have the extreme rigidity, power, and

Bottle mold plungers hard surfaced with Colmonoy No. 6, before and after machining on LeBlond Dual-Drive lathe. Mirror finish (average 10 micro-inches) is achieved in three passes. Plungers are used as they come from the lathe.



smooth transition through a wide speed range required for fine-finish work. One lathe works on the outer contour of the mold plungers, and the other on a cooling plug for the plunger interior.

The plungers are steel parts which have been flame-sprayed with Colmonoy No. 6, a refractory chromium-nickel-boron alloy. This hard-surfacing material has a hardness of 57 to 59 on the Rockwell C scale, making it just barely machinable. By strange coincidence, Overmyer and LeBlond discovered independently that tools with cast-iron-grade carbide tips work best with this hard material.

The plungers are machined in three

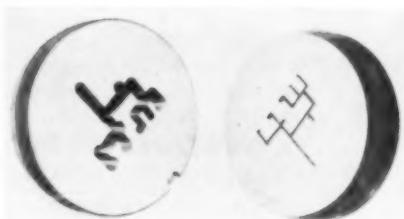
passes at constant surface speed. This requires a steady increase in spindle speed from 125 rpm to 1000 rpm as cutting progresses. LeBlond tracers were chosen because of the fine, stepless surface they produce, and also because their low stylus pressure makes it practical to use aluminum templates, a considerable advantage on short runs.

By finding a way to finish-machine mold plungers in a single operation, Overmyer Mould Co. has been able to hold costs down while producing a superior product. In the highly competitive glass mold industry, this is no small accomplishment. • • •

## TRACER ATTACHMENT MILLS RELIEFS ON EXTRUSION DIES

■ Automatic milling of reliefs on extrusion dies has been developed by Tracer Control Co., 595 E. Ten Mile Rd., Hazel Park, Mich. A program instituted with the cooperation of Aluminum Corp. of America, has perfected a fast, simple method of producing intricate aluminum dies. The automatic 360° trace machining process permits constant feed rate control and the use of coolants.

Typical of those that can be produced are the extrusion dies shown which were machined on a vertical mill equipped with a 360° contour "Duplomatic" tracer attachment operating from a template. An epoxy cast of the front face served as the template. A channel was cut 11/16" deep with a four flute end mill, 3/32" end diameter and 3° taper. Spindle speed was 2100 rpm and the coolant used was Mystic Mist spray. On a two-



(Left) Relief machined by Tracer Control Co.  
(Right) Break side of die.

spindle milling machine, bolster and relief will be cut simultaneously.

Constant feed control within 5% at feeds of .200" per minute with .040" cut can be maintained. A constant rate of .125" per minute is possible when cutting with the full diameter of the tool.

Duplomatic attachments are designed for use with conventional machine tools and do not interfere with conventional operation. • • •

"NO OTHER HEAD OFFERS  
SUCH RANGE and VERSATILITY  
ON THE PRODUCTION LINE"\*

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\* For example, you can add to the basic head one or more of 20 optional accessories (such as Spindle Assemblies, Spindle Cluster Plate, Base Plate, Guide Rods, etc.) to meet the requirements of a particular job.

With Jarvis Heads you have a greater selection of parts and accessories. A buy-only-what-you-need, custom-built head without having to pay the high cost of regular custom designed heads.

Universal joints are of an advanced structural design which feature: low deflection rate; superior fatigue resistance; greater overload capacity and longer life. Joints have a snap-on feature and can be slipped off the spindle without use of tools.

### EXCLUSIVE JARVIS FEATURES

Cut-away view (below) reveals high strength, light weight aluminum alloy castings, heavily ribbed for durability; gears and spindle drivers run in ball bearings, have more than thrust load capacities; idler gears mounted on heavy duty needle bearings running on specially heat treated steel studs; adjustable outrigger arms locked in position with threaded studs located in double "T" slots for positive positional settings

DOUBLE "T" SLOTS,  
NOT FOUND ON  
MOST OTHER HEADS,  
ADD RIGIDITY

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Western Tool Show

**Jarvis** CORPORATION

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October, 1960



### NO NEED TO INVENTORY SEVERAL FIXED HEADS

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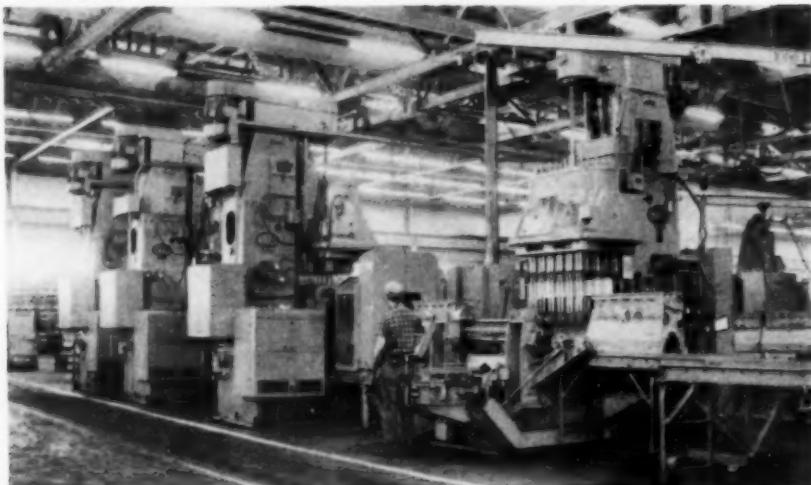
Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

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City & State \_\_\_\_\_

## TRANSFER LINE RAISES PRODUCTION



Natco convertible transfer line consists of three two-way machines and one vertical multiple-spindle drilling machine. Two rollover transfers are included in the line.

For years machine tool builders and users have dreamed of tying conventional tools together into a single "transfer machine" which would have the production potential of single-purpose equipment, and the change-over versatility of general-purpose machines. Caterpillar Tractor Co., Peoria, Ill., working with National Automatic Tool Co., Richmond, Ind., has finally made the idea work.

The new Caterpillar line machines 4 and 6 cylinder diesel engine blocks for the famous D-4 and D-6 "Cats". It includes some 30 separate machines, tied together with conventional transfer equipment. Virtually all the machines are conventional, too (the exceptions are "Cat-type" deep hole drilling and reaming machines built by Caterpillar.) Even the Natcos which form part of the line are conventional—but their method of employment isn't.

The Natco machines are tied together into what Natco calls a "convertible transfer line." It performs what Caterpillar describes as "progressive production."

The line consists of four standard Natco multiple spindle drilling machines—three two-way machines with horizontal and vertical drilling heads, and one vertical machine. The first two perform drilling operations, the third both drilling and tapping, and the last tapping only.

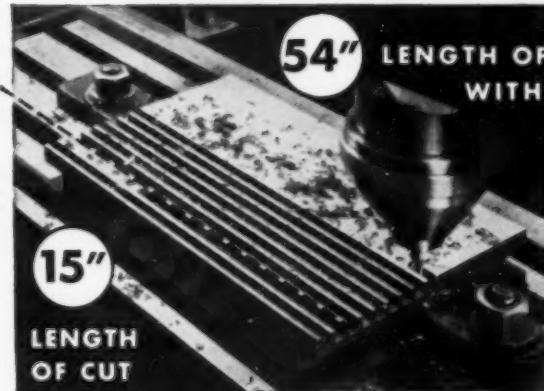
Each machine is a self-contained unit on its own base, with its own hydraulic pump, coolant, and electrical equipment. Each is tooled with its own loading, locating, clamping, and unloading fixtures. Each machine is linked to the next by transfer mechanisms that automatically convey the part from machine to machine,



FOR THAT EXTRA EDGE IN PRODUCTION!

## 3½ TIMES MORE END MILL PRODUCTION with the New B&S Thriftmill® in Competitive Shop Tests!

20% Lower Initial Cost, Superior Microfinish  
and Less Downtime also Proved using new  
B&S Thriftmill.®



**54"** LENGTH OF CUT  
WITH B&S  
THRIFTMILL

**15"**  
LENGTH  
OF CUT  
WITH BRAND  
"X" END MILL

### TEST DATA

#### MATERIAL:

MATERIAL: AISI-D3  
oil hardening tool steel.  
Hardness, Rockwell  
C-18.

#### BOTH END MILLS

1/4" Dia., 4 flute.



### CUTTING DATA

	RPM	SFM	CHIP LOAD	TABLE FEED	DEPTH CUT	WIDTH CUT	LENGTH CUT
B&S Thriftmill®	325	43	.00125	1%" data-bbox="635 550 914 625"/>	14"	1/2"	54"
BRAND "X" End Mill	325	43	.00125	1%" data-bbox="635 550 914 625"/>	14"	1/2"	15"

### MICROFINISH AFTER TESTS

B&S Thriftmill, bottom of slots, RMS 35.

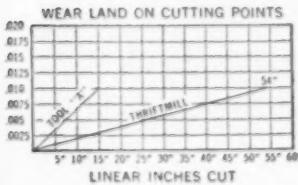
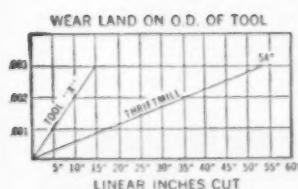
B&S Thriftmill, sides of slots, RMS 30-38.

BRAND "X" End Mill, bottom of slots, RMS 70-100.

BRAND "X" End Mill, sides of slots, RMS 40-60.

The initial economy of the new B&S Thriftmill, together with the proven production benefits engineered into this fine tool, gives a competitive advantage to all B&S Thriftmill users. Now available in 2 flute, 4 flute, single and double end.

There are 1065 different "standard" off-the-shelf B&S end mills to choose from. End wonder, worry and wait—take advantage of B&S tooling superiority and speedy service—call your B&S Distributor now.



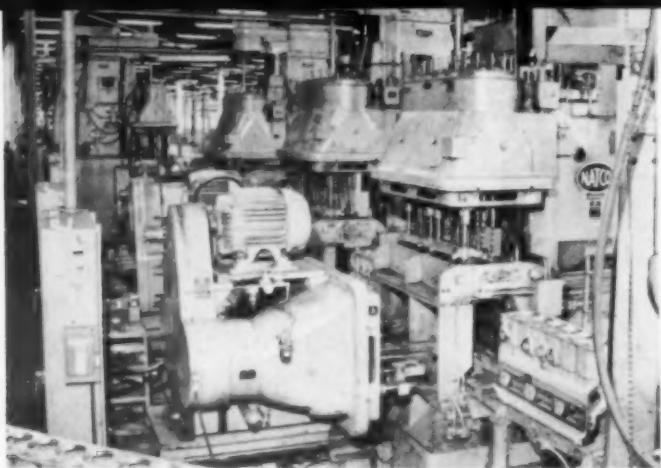
Send for "Condensalog" to: Cutting Tool Division, Brown & Sharpe Mfg., Co., Providence 1, R. I.

**Brown & Sharpe**

HIGH SPEED STEEL CUTTING TOOLS

**NELCO**

CARBIDE CUTTING TOOLS



Viewed from above, the compact, integrated nature of the line is emphasized. Each of these machining units is an individual machine, capable of being operated independently in or out of the line.

and perform orienting jobs such as rollover.

Machining heads on these Natcos are fully adjustable.

Natco-designed electrical controls make the transfer idea feasible. Each standard Natco is built for automatic cycling by itself.

The master control panel actually has only five push buttons—and only three are used for routine operation: Motor start, cycle start, and master stop. (Two other buttons—traverse forward all heads, and traverse reverse all heads—are included for setup and maintenance purposes.)

Each machine has its own control panel, so that the operator has the option of operating the machines singly or as a four-machine unit.

This Natco convertible transfer line is not a high volume "mass production" system in the usual sense. Neither is it a low volume "job lot" system. Its function lies somewhere between, in an area which Natco calls "medium production", and which covers a spectrum of manufacturing in which much improvement in productivity is not only possible but imperative.

• • •

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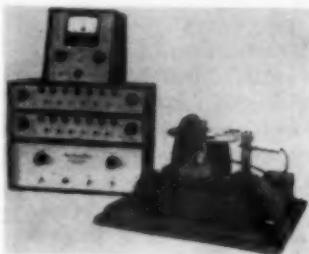
how to  
MICROtrol®

## machine tools...



### for MICROTolerance Inspection

The MICROTrol Standard Comparator Amplifier (16011) shown here is one of four units designed for precise, reliable dimensional inspection in a variety of applications. The building block concept makes all MICROTrol units extremely versatile as components of either user-built or AIL custom-built systems.



### for Fast Automatic Selection

Operated in combination with selected accessory units the 16011 amplifier is readily adapted to automatic sorting. Here it is shown with the MICROTrol 16082 classifier in a high precision production sorting operation.



### for Precise Continuous Control

The addition of appropriate logic and decision making MICROTrol units provides complete feedback control. A typical system, shown here, combines the high accuracy and reliability of MICROTrol units with our unique linear actuator—the INCHWORM®.

\*Trade Mark

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A typical Hydro-Cam Smooth-Edge blanking die opened to show construction details. This

die produces the O-ring seal plate illustrated below.

## PROCESS PRODUCES PRECISION BLANKS WITH STRAIGHT, SMOOTH EDGES IN A SINGLE OPERATION

■ A new, cost-saving, high-speed, stamping process, called the Hydro-Cam Smooth-Edge blanking process, produces precision stamped blanks with straight, smooth edges in a single operation. Developed by Hydro-Cam Engineering Company, 1900 E. Maple Rd., Troy, Mich., the new process can completely eliminate shaving operations normally required to provide a stamped blank with a smooth, straight edge. The surface finish produced in the blank edge by a one-stroke operation compares with that achieved by grinding. Accuracy of 0.0005" and closer is possible with the Smooth-Edge blanking process.

Parts such as gears, gear racks, pieces with precision holes or contours, small extrusions and any other type where smooth, accurate edges are imperative, are ideally suited to Smooth-Edge blanking.

The process is carried out on either coil or strip stock with special dies in a triple-action, high-speed, hy-



This 0.047" thick steel O-ring seal plate has been produced in a wide range of hardnesses by the Smooth-Edge, one-operation blanking process. Note the smoothness of the holes achieved in this relatively thin part.

draulic press capable of up to 120 strokes per minute.

The dies are made in such a manner that the material is firmly clamped during the shearing sequence. Thus, material along the line of shear is restricted from flowing or tearing, and a smooth edge results.

The process has been successfully carried out with steel parts having a wide range of hardnesses, and others

SMOOTH-EDGE  
BLANK



BLANK STAMPED WITH  
CONVENTIONAL DIE

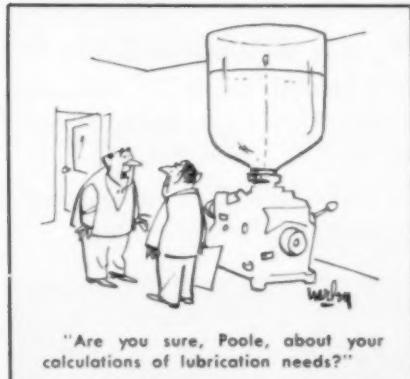


BLANK STAMPED WITH  
CONVENTIONAL DIE AND  
THEN SHAVED



Magnified (8X) views of edges of stampings produced by various stamping methods. At the top is the edge of a stamping produced by the Hydro-Cam Smooth-Edge blanking process. In the middle is a part blanked by a conventional die. Note the normal tearing and built-up sheared edge. At the bottom is shown the edge of a blank that has been first stamped and then shaved. Note that the built-up sheared edge at the bottom is still on the part.

made of brass aluminum and copper. Thin precision parts from 0.010" to 3/16" thick and thicker, with several holes, have been made with smooth holes and edges. • • •



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ALL SIZES 17/64 THROUGH 3"

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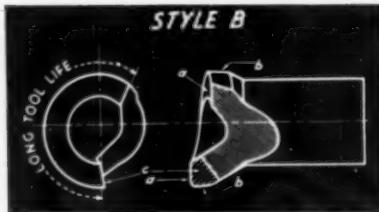
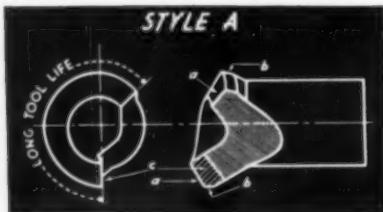
If you are using high speed drills, you will find that for most jobs carbon will work just as well—and better in some cases. We urge you to try them as you will realize a saving of at least 50%. Order now!

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Boring Chuck



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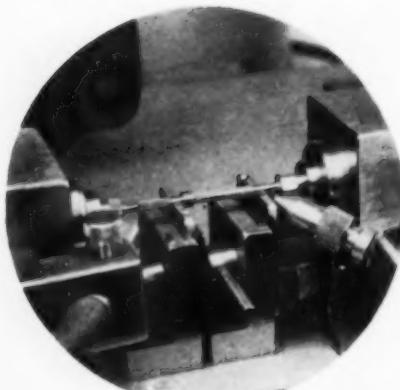
Standard Drill Bushing



Wedge-Lock  
Production Vice

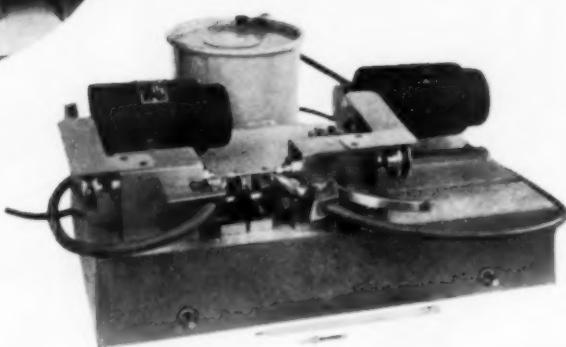
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Quality Product**

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### **J & S SMALL CENTER LAPPING MACHINE**

& S Tool Company has introduced a new center lapping machine, made especially for lapping centers in small parts. This new precision unit makes it possible now to lap standard as well as recessed center holes from  $1/16$ " diameter and larger, at a highly increased rate of production.

#### **SIMULTANEOUS LAPPING**

Designed to lap both centers simultaneously in pieces up to 8" long, the J & S Small Center Lapping Machine has two opposing precision high-speed spindles which are individually driven by 10,000 r.p.m. motors with reversible switches.

#### **SPECIAL DESIGN FEATURES**

One spindle is mounted on ball ways to permit a gentle lapping motion. The workpiece is held in two adjustable V's, permitting center holes to be offset in relation to the diamond lap. This creates a semi-grinding operation in conjunction with a small differential speed of the spindles, which also produces the rotation of the parts.

Other important features include interchangeable diamond-impregnated center laps, and mist coolant mounted in position for cooling and cleaning the laps and centers.

**Additional Data Available on Request**

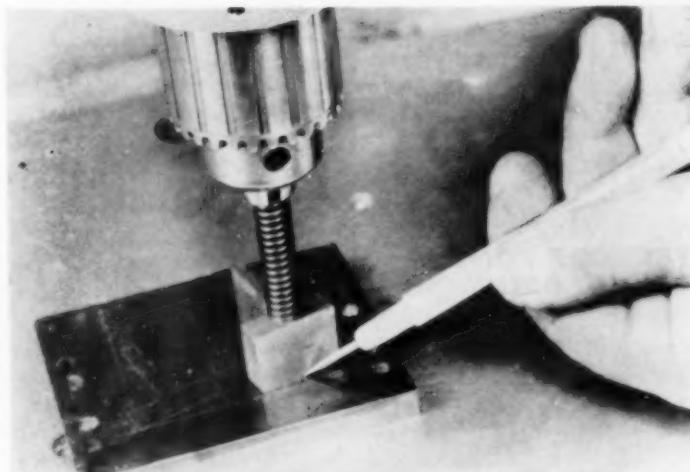
**J & S TOOL CO., INC.**

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## shop hints and kinks



### DIE MAKER'S LAYOUT KINK

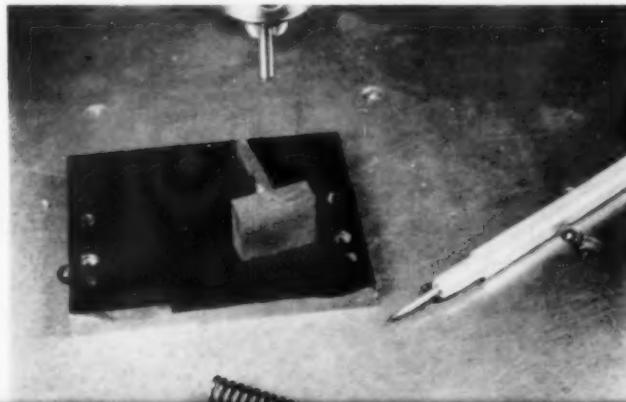
By H. J. Gerber

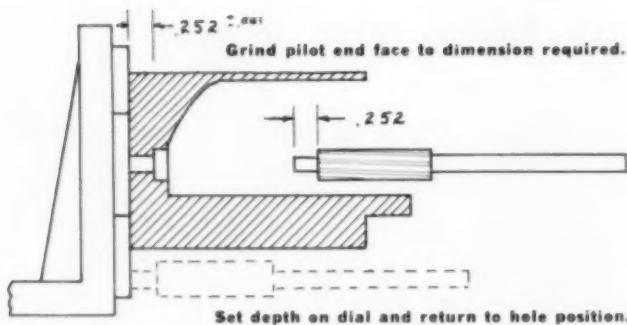
■ Layout of dies and stripper plates is made easy by the illustrated method for holding a punch or templet in tight contact with the work.

The layout job shown is set up in a bench drill press. A strong compression spring, retained by a dowel pin in the chuck, is used to hold the

punch tightly against a die block so that its outline may be scribed to the die. The quill of the drill press has been locked in the down position to hold the spring in compression. Layout can now be made with no danger of the punch or templet slipping out of place.

• • •





## COUNTERBORE FOR SHORT RUN BORING MILL

By Erwin Antlitz

■ Each piece machined had to be indicated to set, and then clamped on an angle plate on a boring mill. Due to the small number of pieces,

only ten, tooling up for this particular job would not be practical. This meant changing tools in the chuck for each operation on each piece until all operations were performed—center drill, drill, and counterbore.

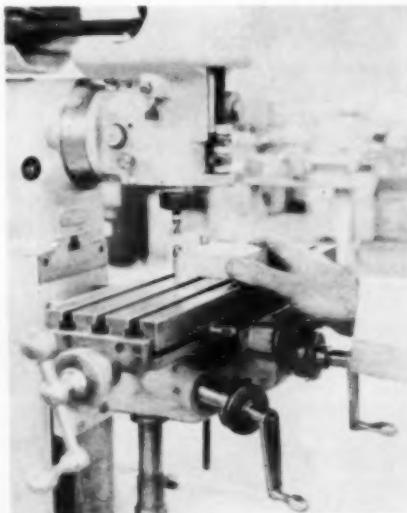
• • •

## ACCURATE MILL SETUPS WITHOUT INDICATING

By Norman Fried

■ The T-bolt slots in most milling machine tables are machined precisely parallel to the table's lengthwise travel. We take advantage of this fact in our shop to cut down on setup time for machining work and mill fixture placement.

Two hardened and ground pins are used as shown in the photograph. They are inserted upright in the mill table slot and one edge of the work is brought up snugly against the pins for alignment and clamped in place. Our mill fixtures are quickly positioned in this manner also, the reference edge of the fixture being placed in contact with the pins and then clamped.



Paper shims may be used between the pins and the workpiece. After clamping, the shims are pulled lightly to see if the work has shifted; if this has happened, one or both of the shim strips will slip right out. It is then necessary to reclamp and reposition work.

If the right size pins are not at hand for your mill table, dowels and die set lead pins can be used without further work, or they may be turned out of drill rod hardened and drawn to Rockwell 60 C scale. Finish grind pins about .0003" smaller than the slot width. Adjustable parallels may be used in place of the special pins for occasional jobs, or when there are no pins already made up.

We find that the parallelism obtained from a piece set up in this manner is from .0005" to .002" per foot, depending on the condition of the mill and table slots. This method saves considerable indicating and tapping work into alignment and makes for a speedy, reliable setup. • • •



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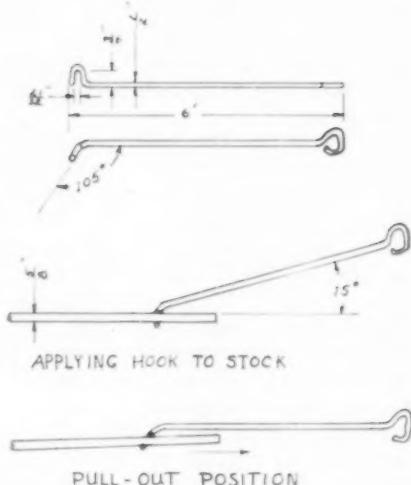
## HOOK FOR PULLING OUT HOT BARS

By John Breen

■ Illustrated is the type of hook that we use for pulling hot bars out of furnaces of up to 1800° and 2000° temperatures. Twenty or thirty bars are put on such a furnace hearth at one time. A particular heating time is necessary. At the end of that period comes the "hot" job of pulling out the bars.

As the furnace door is raised to pull out a bar, a great amount of heat is naturally oppressive to the workman. In fact, it is so intense he cannot come within close range. Therefore, the workman needs a long pull-out hook.

We do not use a heavyweight hook as it would cause the operator to become fatigued in using it. In the example shown, a  $\frac{1}{2}$ " dia. hook is used. A hook eye is formed on one end so as to act as a pulling handle. A "U" bend is put on the gripping end with the inside dimension  $1/32$ " larger than the diameter of the rod stock. This "U" bend plane is  $105^\circ$  in relation to the straightaway of the so-called hook.



This furnace pull-out hook is applied to the bar in a  $15^\circ$  position. It is then swung around to a parallel position with the stock. The "U" bend will then grip itself to the stock, and it can then be pulled out of the furnace.

This tool has proven very useful to us. We use it in many lengths and many "U" bend opening sizes. • • •



### SPELLMACO "SPOTTERS"

A matched set of transfer punches  
for toolmakers, machinists & tool cribs  
Used for transferring location of threaded, drilled  
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Precision made of finest tool steel—Carefully heat treated and tempered for long life—0025 undersize to facilitate use—Black oxide finish  
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# free literature

12

To receive copies of booklets described below, circle their identifying numbers on an Action Card, found opposite pages 80 and 300.



(See Number 1)



(See Number 2)



(See Number 3)

**1. Numerically Controlled Machine Tools.** Two-color 12-page booklet, containing many photographs, describes three types of machines built specifically for numerically controlled operation, and all using continuous path control. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32.

**2. Precision Punches.** 36-page catalog includes many new piercing accessories as well as a complete line of shoulder punches, interchangeable ball seat punches, pilot punches, and set screw punches. The entire Pivot line is illustrated and charted with dimensions and sizes available as standard stocked sizes or specials. Price list is included. Pivot Punch and Die Corp., N. Tonawanda, N.Y.

**3. "The V.M.U. System of Milling"** is the title of 24-page catalog listing nearly 500 throwaway insert milling cutter styles and sizes. It covers the complete line of cutter bodies, cartridges, inserts, and accessories for milling cast iron, steel, aluminum, and non-ferrous metals. Valenite Metals, Div. of Valeron Corp., Box 205, Royal Oak, Mich.

**4. Air Cylinders, Valves, Clamps, and Dial Feed Tables** are illustrated in 88-page catalog. Price list is included. Allenair Corp., 255 E. 2nd St., Mineola, N.Y.

**5. Lathe Accessories.** Bakewell master tool posts and tool holders, fitting any make or model lathe, are described in four-page bulletin available from Rhucor, 1313 Lincoln Ave., Pasadena 3, Calif.

**6. Alloy Steel Band-Saw Blade.** Specification sheet provides description of the Lenox Master-Band, specification chart, information on Lenox True-Weld process, and a cutting chart. American Saw & Mfg. Co., Springfield, Mass.

**7. Positioning Table.** The Cleereman positioning table is tape controlled to provide automatic point-to-point positioning quickly and accurately. Literature points out why and how the Warner & Swasey Tele-Probotmat numerical control system is used with the positioning table. Cleereman Machine Tool Corp., Green Bay, Wis.

**8. "Machine Tool Electrical Standards,"** recently revised, presents the latest thoughts of many skilled minds in the machine tool field, in keeping with the latest technological developments. Recognizing the increasing use of electronic and static devices, information on this equipment is included for the first time. National Machine Tool Builders' Assn., 2139 Wisconsin Ave., Washington, D.C.

## FREE LITERATURE continued

**9. Copper and Brass Hammers**, with built-in safety features, are described in flyer. Complete tables or charts show the weights, lengths, and types of handles available. The Hackett Brass Foundry Co., 1202 Lillibridge St., Detroit 14.

**10. Air Guns**—a blow gun, production gun, and Easy-Grip air guns—are illustrated and described in literature. Also announced is the all-new Magnatrac adjustable air valve Model M-200 for constant flow applications in shop or on production lines. Future Products, Inc., 3725 E. 13th St., Indianapolis 1.

**11. Carbide Cutter and Rotary Files.** Dimensions and prices are given for these cutters. Beaver Cut carbide cutters are 2 1/4" O.A. with 1/4" dia. shank. Resharpening service is offered. Folder from Beaver Cut Rotary File Co., 400 E. Slauson Ave., Los Angeles 11, Calif.

**12. Punches, Shears, Presses.** Hydraulically operated hydraulic presses for punching, shearing, forming, etc. are described in 56-page catalog. The company's line of portable and bench-mounted hand-operated punches and presses is included, as well as a portable hand-operated shear. Descriptive and specification data is given for hydraulically powered machines from 5 to 90 tons capacity. W. A. Whitney Mfg. Co., 636 Race St., Rockford, Ill.



(See Number 12)



(See Number 13)



(See Number 14)

**13. Multiple-Spindle Drillheads.** 28-page catalog describes six types of drillheads—fixed center, angular, rotating, double eccentric adjustable, single eccentric adjustable, and universal joint adjustable. Tapping attachments and "tap-or-drill" units are also described. Thriftmaster Products Corp., Lancaster, Pa.

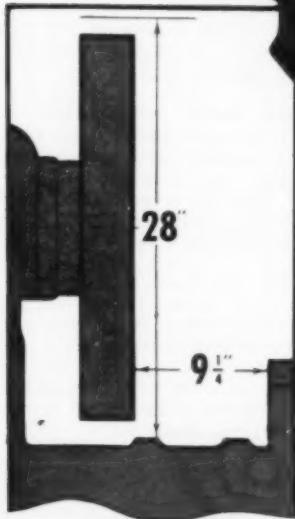
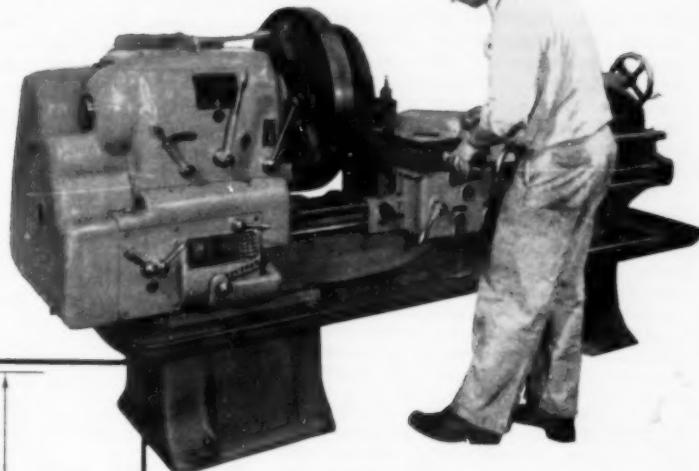
**14. Bending Machines.** Complete line of rotary benders for the forming of tube, pipe, bars, structural shapes, channels, etc. from steel, stainless steel, copper, brass, aluminum, etc. are described in new catalog. Benders range from hand to fully automatic hydraulic models. Sizes range from 1/4" O.D. tube to 17" O.D. pipe. Wallace Supplies Mfg. Co., 1304 Diversey Parkway, Chicago 14, Ill.

**15. "H & G Cutting Oil Chart"** has been compiled as an aid to help select the proper grade of cutting lubricant for various materials. The chart comprises most of "Die Headlines," Vol. V, No. 3, published by The Eastern Machine Screw Corp., 140 Truman St., New Haven, Conn.

**16. Bench Center.** The Metron universal gauge stand M24, built up of standardized measuring components, is featured in brochure. Illustrations and specifications for the measuring accessories are provided. Skandia Tool Sales, 3507 E. Olympic Blvd., Los Angeles 23.

**17. Color Filling Machine.** Bulletin No. 15K presents the Acroprinter Model No. 301 for coloring lettering or design in depressed or on sunken surfaces. Acromark Co., 15 Morrell, Elizabeth, N.J.

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**FREE LITERATURE** continued

**18. Flanging Machines & Circle Shears.** Catalog No. 60 illustrates and describes flanging machines with capacities in mild steel of  $1\frac{1}{4}$ ",  $2\frac{1}{8}$ ",  $1\frac{1}{2}$ ",  $2\frac{1}{2}$ ", and  $3\frac{1}{4}$ ". Other machines include  $1\frac{1}{4}$ " and  $2\frac{1}{2}$ " cap. circle shears;  $3/16$ " cap. elliptical head shear and flanger, and a 10 ga. cap. circle flanger and shear. Blue Valley Machine & Mfg. Co., 6830-34 Truman Rd., Kansas City 26, Mo.

**19. Disc Grinding Wheels.** The company's many types of these wheels, desired wheel characteristics necessary for efficient disc grinding, and recommendations for disc grinding of various products and materials are included in brochure. Macklin Co., 2917 Wildwood Rd., Jackson, Mich.

**20. Gear Driven Drilling Machine.** with 30" swing  $1\frac{1}{2}$ " drill capacity, is presented in four-page brochure, with dimensions and specifications. I.O. Johansson Co., 7248 St. Louis Ave., Skokie, Ill.

**21. Point-to-Point Numerically Controlled Positioning Equipment.** 12-page booklet comprises machines providing the following types of numerical controls: tape control of a single axis—horizontal and vertical rotary tables; tape control of two axes—jig borers, in a complete range of sizes; tape control of three axes—linear-rotary combination machines; jig borers with built-in rotary tables; tape control of spindle—jig borers with automatic control of spindle speed, feed, and

boring depth. Pratt & Whitney, W. Hartford 1.

**22. Lathes, Milling & Drilling Machines.** 96-page Catalog 1960 shows the complete line of South Bend engine lathes, toolroom lathes, turret lathes, milling machines, shapers, drill presses, and pedestal grinders. A considerable portion of the catalog is devoted to tools, attachments, and accessories for the machines. South Bend Lathe, Inc., South Bend 22, Ind.

**23. Single Spindle Bar & Chucking Automatic.** Catalog No. 460 gives detailed descriptions and illustrations of the redesigned Cleveland 3" Model AB. Among the innovations of the machine is the precision feed monitor that indicates exactly, in ipm's, the feed rate for each forward and reverse setting of the five turret tools. The Cleveland Automatic Machine Co., Cincinnati 12.

**24. Four Belt Sander Attachments** for portable tools are highlighted, with light weight, ample motor horsepower, and choice of spans of 8", 12", and 18" emphasized. Brochure is available from Jonvir Manufacturing Co., 15733 Jas. Couzens Highway, Detroit 38.

**25. Vibratory Machines.** Descriptions, illustrations, and technical information are provided on Almco's seven vibratory machines. These Vibrasheen models provide tub capacities that range from a full  $3\frac{1}{4}$  gallon to a 17 cu. ft. capacity. Almco, Queen Products Div., King-Seeley Corp., Albert Lea, Minn.



(See Number 21)



(See Number 22)



(See Number 23)

## FREE LITERATURE continued

**26. Marking and Numbering Machines.** Revised 1960 130-page catalog covers more than 590 indexed items including hot stamping machines, name plate stamping machines, roll-leaf, inks, steel stamps, rubber dies, etc. The Acromark Co., 15 Morrell St., Elizabeth, N.J.

**27. Air/Hydraulic Power Cylinders.** Four-page bulletin gives the strokes, prices, and dimensional data on Miller's expanded "Stock" selection of air and hydraulic power cylinders. Miller Fluid Power Div. of Flick-Reedy Corp., Bensenville, Ill.

**28. Milling Head.** The Player milling head has the advantages of quill clamp, instant stopping, hand wheel feed, rack feed manual, etc. Other features, and specifications, are outlined in brochure from Joseph Player, 37450 Wick Rd., Romulus, Mich.

**29. Precision Small Hole Drill Jig Bushings** are offered in recent catalog, with over 2000 standardized bushings and liners in several types and body sizes, also all A.S.A. standard types with hole sizes ranging from .005. Prebco Bushing Co., 14714 E. Arrow Hwy., Baldwin Park, Calif.

**30. Large Capacity Center Lathe.** Ensign 13" lathe, which will swing 15 $\frac{3}{4}$ " over the entire bed and 17 $\frac{1}{2}$ " in front of the faceplate without using a gap, is built in two bed lengths giving 24" and 36" between centers. Eight-page catalog

from Elliott Machine Tools, 737 Boylston St., Boston, Mass.

**31. Cartridge-Type Toolholders For Throw-Away Inserts.** The 18 standard cartridge-type toolholders that comprise the Wesson Insert-Cartridge System for assembling an unlimited variety of single or combination boring, facing, and recessing tools are described in Bulletin C-660. Wesson Co., 1220 Woodward Heights Blvd., Ferndale 20, Mich.

**32. Packaging Machine.** Sundstrand Model 50A Packmaster automatically packages hard and soft goods at rates up to 150 per minute. Packages, in sizes from 2" to 8" wide and 2" to 16" long, are made of heat-sealable foils, films, or paper. Sundstrand Machine Tool, Belvidere, Ill.

**33. Spindle Repair Service.** Bulletin R-3 describes and illustrates Pope's facilities for prompt repair and renewal of all makes and sizes of belt driven, motorized and high cycle spindles for grinding, boring, drilling, and milling operations. Pope Machinery Corp., 261 River St., Haverhill, Mass.

**34. Power Feed Drill Presses.** New line of Delta 20" drill presses is described in 12-page Bulletin 100M. The Rockwell power feed affords up-front control combined with one-hand operation. 18 models include bench, floor, multiple-spindle, and an overhead track-mounted tool. Rockwell Manufacturing Co., Delta Power Tool Div., 473 N. Lexington Ave., Pittsburgh 8, Pa.



(See Number 29)



(See Number 30)



(See Number 31)

## FREE LITERATURE continued

**35. Gage Blocks.** Heavy duty gage blocks in 84, 48, 36, and 24-block sets, and square gage blocks in 88, 85, 84, 81, 36, and 34-block sets, are described in available literature. Both feature new accuracies (A, +.000006", -.000002"; A+, +.000004", -.000002"). Webber Gage Co., 12900 Triskett Rd., Cleveland 11, Ohio.

**36. Disc Grinders.** 8-page catalog presents the company's line of high production precision disc grinders, both horizontal and vertical, with dimensions and specifications. Featured is the Besly DH 4 double horizontal spindle disc grinder with sealed spindle quill construction. Besly-Welles Corp., South Beloit, Ill.

**37. Carbide Tipped Saws.** In addition to many new items in the Meyers' line, an entirely new selection of thin-rim saws is now offered, with each item plainly priced. The Meyco carbide tipped saws are offered with a complete selection of square, uni-chip, or alternate top bevel tooth styles. This catalog with a full listing of the Meyers' Mainline, Safety-line, and Customline brand of saws is available from The W. F. Meyers Co., Inc., Bedford, Ind.

**38. Flexible Shaft Machine Accessories.** including arbor style ball bearing hand spindles, collet style ball bearing hand pieces, collet and arbor style right angle heads are illustrated in literature from N. A. Strand Flexible Shaft, Inc., 601 S. Washtenaw Ave., Chicago 12.



(See Number 39)



(See Number 40)



(See Number 41)

**39. Shears and Flangers.** Bulletin 70G covers Niagara's complete line of redesigned ring, circle, slitting shears and flangers for medium and heavy work, with detailed features, specifications, and accessories provided. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y.

**40. Gear Shavers.** In addition to pointing out exclusive features of the Mark II machines, Bulletin No. 870-60 covers the three methods of shaving that can be used: underpass, transverse, and modified underpass, and shows how set-up procedures are simplified. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12.

**41. End Mills & Milling Cutters.** As recently announced, the new line of Cleveland milling cutters embraces a wide range of the most popular types, including plain, side, half side, concave, convex, corner rounding, woodruff key seat, angle and screw slotting cutters, and metal slitting saws. They supplement the recently improved and enlarged line of Cleveland end mills. Booklet from The Cleveland Twist Drill Co., P.O. Box 6656, Cleveland 1.

**42. Die Filing Machines.** Three models of the Keller die filer, for filing, sawing, and lapping, are described in folder. Standard stroke is 1½" and two speeds from 350 to 450 rpm are available by changing the belt. Sales Service Mfg. Co., 2363 University Ave., St. Paul 14.

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Pendant control



Tape control



and a variety of combinations of the three for flexibility of control suited to the type of work required.

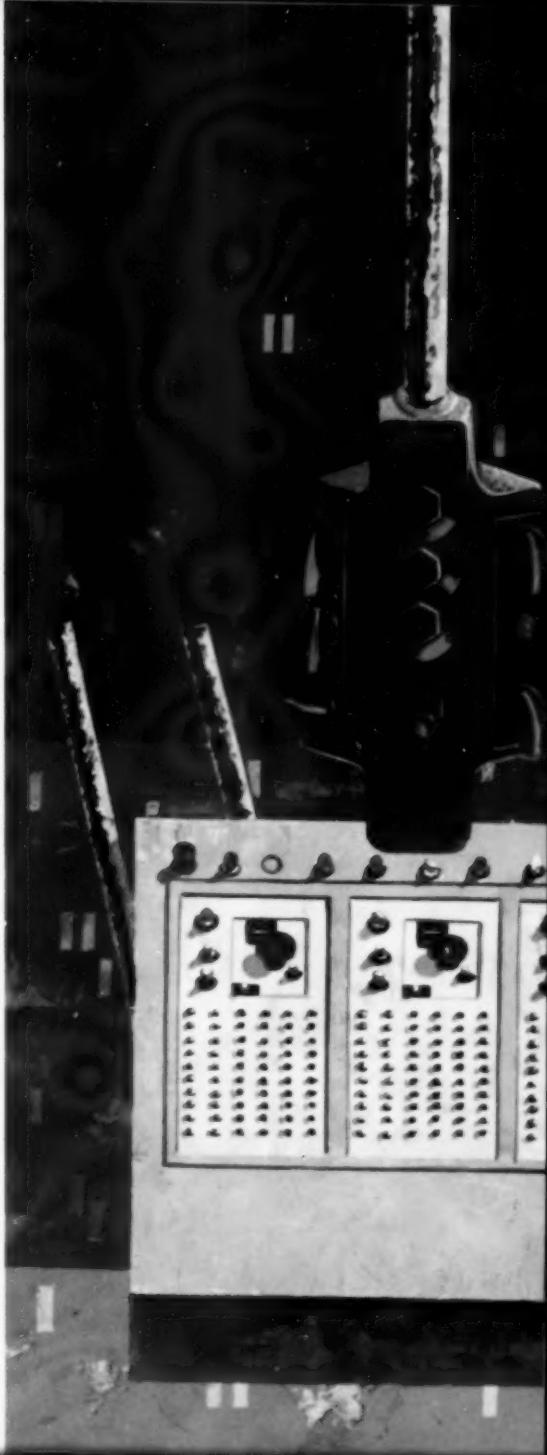
For example . . . The Multiple Control Pendant selects speeds, feeds, unit travels, rapid traverse of head, table, saddle and spindle, plus the rotation of the spindle forward and reverse, jog and stop. Speeds and feeds can be pre-selected while the machine is in operation.

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**43. Grinding Fixture.** Harig's improved Grind-All Fixture for grinding irregular shaped perforators is the subject of recent literature, which also includes information on Harig's radius dresser arm and ball-seat punch adapter. Harig Manufacturing Corp., 5751 W. Howard St., Chicago 48.

**44. Rotary Tables.** Four-page illustrated bulletin describes new additions to the firm's line of hand- and power-revolving index tables. The Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23.

**45. Lapping Manual** and catalog covers lapping techniques, laps, lapping tools, and lapping machines. American Lap Co., 20180 Sherwood, Detroit 34.



(No. 47)



(No. 48)

**46. "Newest Developments in Gear Honing"** presents a new machine—the Red Ring Model GHD gear honer. A four-way honing feature, crown honing possibilities, and machine operating details are discussed. National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

**47. Precision Gears.** "PIC Specifications and Standards" outlines specifications established on low inertia, custom made, certified military type, fine pitch spur gears, for the purpose of offering a better understanding between manufacturer and customer. PIC Design Corp., 477 Atlantic Ave., East Rockaway, N.Y.

**48. Presses and Press Brakes.** 24-page condensed catalog describes Verson mechanical and hydraulic presses and press brakes, hydraulic shears, press and press brake tooling, and special machinery. Verson Allsteel Press Co., 9300 S. Kenwood Ave., Chicago 19, Ill.

**49. Presses For Pressure Processing.** 16-page bulletin describes the entire H-P-M line which includes metalworking presses, custom hydraulic presses, dieing machines, plastic molding machines, etc. Hydraulic components are also listed. The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

**50. New Line of Live Centers.** 12-page folder contains illustrations, diagrams, and specifications of this precision-built live center with accuracy better than .0001". J & S Tool Co., Inc., 87 Dorsa Ave., Livingston, N.J.

**51. Armstrong "Saw Engineer,"** No. 79, includes articles covering saw filing, running sliver teeth on wide band saws, band saw swages, etc. Published by Armstrong Mfg. Co., 2135 N.W. 21st Ave., Portland 8, Ore.

**52. Tool Bits.** Discussed is the latest addition to the company's tool bit line —Circle T-15—a tungsten base, high vanadium, high cobalt type high speed steel with superior abrasion resistance and red hardness. Firth Sterling Inc., 3113 Forbes Ave., Pittsburgh 30.



(No. 53)



(No. 54)

**53. Coated Abrasive Products.** 46-page catalog comprises illustrations, specifications, and prices on products such as cartridge rolls, abrasive spirals, bands, discs, wheels, mandrels, etc. Field Abrasive Mfg. Co. Inc., 1303 Stanley Ave., Dayton 4, Ohio.

**54. Standard Diamond Tools.** Catalog No. 460 features diagrams, specifications, and pricing information on 232 standard diamond tools. In addition, illustrated sections cover cluster and impregnated tools, radius dressing tools, boring and turning tools, etc. The Staset Co., Inc., W. Orange, N.J.

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## FREE LITERATURE continued

**55. Mechanical Press Brakes.** 50-page revised Catalog No. 2023-B covers latest features and new models added to the Steelweld press line. The table on specifications has been greatly enlarged and covers machines from 160 to 1250 tons, mid-stroke capacity. Steelweld Machinery Div., The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

**56. Tubing Selection Guide** makes easy selection of steel tubing according to type, finish, analysis, formability, machinability, weldability, and relative cost. Bulletin 12-10 from Joseph T. Ryerson & Son, Inc., Box 8000-A, Chi. 80.

**57. Heat Treating Furnaces & Ovens**, in numerous models, are listed with specifications and prices. Furnaces are also built to order. K. H. Huppert Co., 6830-40 Cottage Grove, Chi. 37.

**58. Mist Coolant.** Application methods for various standard machining operations, using the firm's Spraymist, are shown in

six-page, gate-fold booklet from Bijur Lubricating Corp., Rochelle Park, N.J.

**59. Drill Press Tapping Equipment.** Procunier high-speed tapping attachment (with new "Tru-Grip" tap holder), the heavy duty Tap King, other tapping attachments and heads, are included in brochure from Procunier Safety Chuck Co., 18 S. Clinton, Chi. 6.

**59. Thread Gage.** A brochure describing the new SPV universal thread gage is available from Homestrand Machine Tool Corp., 392 W. Putnam Ave., Greenwich, Conn.

**61. Radial Drilling Machines.** The Raboma Co. of West Berlin, for long exclusively engaged in the building of radial drilling machines, has developed a radial drill with "automated operation," meaning automatic run-off of all operating steps. This is said to make the machine a modern cost conscious production tool. Well illustrated booklet points out important parts, and provides technical data. Columbia International Corp., 10-35 44th Dr., Long Island City 1, N.Y.

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Cut Thread Studs  
Tee Nuts  
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## book review

### **Mechanical Press Handbook**

(Published by Metalworking Magazine, 221 Columbus Ave., Boston, Mass. 256 pages. \$5.00.)

Technical books that are both basic and comprehensive are scarce indeed—they are too few to fit industry's needs. This new work on mechanical presses is just such a book. It is basic enough to be understood by the near neophyte and comprehensive enough to be of use in almost every stamping plant.

Written in clear, easy-to-read language, the book's 15 chapters cover the range of mechanical press design and use from basic components to highly sophisticated, complete operating units.

Two particularly interesting chapters deal with transfer and high-productivity presses. Both types are becoming more important in these days of automation and stepped-up production lines.

About half the space on transfer presses is devoted to loading and slide design. Methods of loading vary, of course, according to the requirements of the customer and the stamping he is producing. The authors have done an exceptionally fine job in covering this phase, pointing out important factors that should be considered when selecting types of feed.

High productivity is the term given by the authors to describe presses that have been equipped with automatic feeding devices and that are used in continuous operation as opposed to single stroking. Besides information on types of equipment, the authors also discuss economics, giving a clear picture of the role these high-precision machines can play in modern industry.

The book has a definite singleness of purpose that makes it both coherent and readable, even though its scope is extremely wide. Indexes refer to charts and diagrams as well as subjects discussed.

### **Cam and Tool Design**

(By Oscar T. Lippman. Published by Brown & Sharpe Mfg. Co., Providence 1, R.I. 81 pages. \$7.50).

The 81-page book, entitled "Cam and Tool Design" for automatic screw machines, consists of a series of articles written by Oscar T. Lippman, who has taught courses on this subject for over 20 years.

Throughout the "Cam and Tool Design" book, reference is made to three other manuals, also available from Brown & Sharpe. These manuals are: "Construction and Use of Automatic Screw Machines" (\$2.75); "Brown & Sharpe Cam and Tool Design Tables" (\$2.50), and Brown & Sharpe Screw Machine Tools Catalog (free).

#### **Cold Roll Metal Forming**

**The How and Why of Cold Roll Metal Forming** by R. B. Addington. (Published by Addington Co., P.O. Box 411, Para-

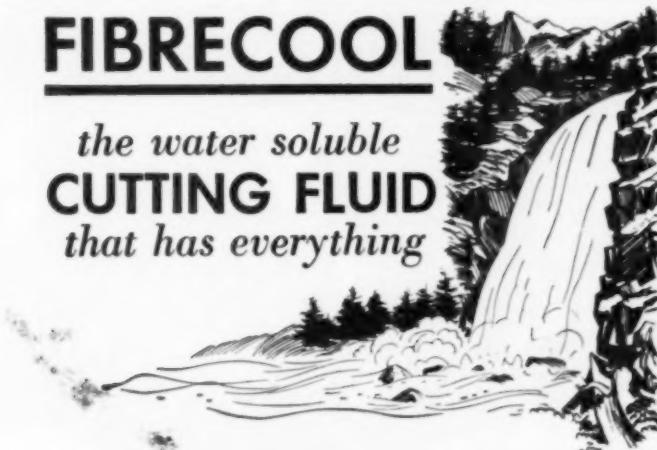
mount, Calif., 848 pages.)

In the book, Addington presents 500 progressive engineering drawings of roll designs for more than 100 different shapes, together with detailed instructions for machining and assembling the roll units required for each pass in the particular forming process.

Addington contends that there are thousands of metal parts which could be more economically produced by the cold roll forming method, and the book attempts to show how and why.

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**CUTTING FLUID**  
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If you produce large rounds or squares, the new Rotator will reduce your cutting time to a minimum . . . 16 to 20 square inches per minute on hard alloys. It's the only rotator-type saw with a chuck that will hold rough forgings and rounds, as well as conventional rounds up to 14" diameter. Material is rotated as it is cut, keeping a cooler surface at the point of blade contact . . . result — longer blade life. Self-contained and portable, with integral tank and re-circulation pump.

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# news of the industry

14

## HITCHCOCK AND DRAKE PUBLISHING MERGE



R. C. Van Kampen



O. A. Feldon



V. C. Hogren

In a joint statement issued August 29, 1960, Robert C. Van Kampen, president of Hitchcock Publishing Co., Wheaton, Ill., and O. A. Feldon, president of Drake Publishing Co., Chicago, announced the merger of the two companies. The new corporation will be known as Hitchcock Publishing Co., Inc. (Delaware). Drake is a specialist in company-sponsored magazines and other promotional services; Hitchcock is a leading publisher of industrial magazines.

Heading the new corporation will be Robert C. Van Kampen, Chairman of the Board; O. A. Feldon, President; and Vincent C. Hogren, Executive Vice President. Patricia Doyle from Drake will head that division under Hitchcock.

Hitchcock Publishing Company was founded in 1898 by A. H. Hitchcock, who pioneered the idea of controlled or qualified circulation publications. After R. C. Van Kampen took over as president in 1937 the company grew rapidly, occupying a new building near Wheaton two years ago.

Hitchcock publications include: **MACHINE & TOOL BLUE BOOK**, Hitchcock's **WOODWORKING DIGEST**, **GRINDING & FINISHING**, **CARBIDE ENGINEERING**, **ASSEMBLY & FASTENER ENGINEERING**, **PLANT MAINTENANCE & ENGINEERING**, **MODERN PASSENGER TRANSPORTATION** and **SCHOOL BUS TRENDS**.

Hitchcock's new president, O. A. Feldon, is widely known as "Dutch" throughout the industrial field. He began his business career with McGraw-Hill Publishing Co., later becoming

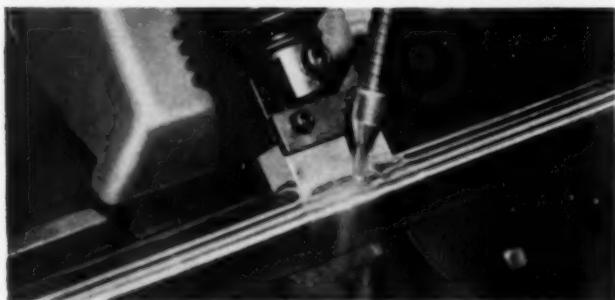
vice president and director as well as western manager for MacFadden publications. In 1948, he organized his own company under the name of Drake Publishing Co., which specializes in consumer sponsored magazines and business books.

V. C. Hogren was advertising and sales promotion manager of Acme Steel Co., Chicago, before joining Hitchcock in 1944. He has been executive vice

president for a number of years.

As a result of the merger, other publications will be acquired and new ones started in fields not being adequately covered at the present time. According to Mr. Van Kampen, the merger is a logical step in the progress and future growth of Hitchcock Publishing Co. The acquisition of Drake will broaden the scope of Hitchcock activities and diversify its interests.

## MICROSTONING



### New! SUPFINA Produces revolutionary $\checkmark$ <sup>controlled</sup> $\frac{\text{microinch}}{\text{microinch}}$ Surface Finish!

Microstoning, by Taft-Peirce/Supfina, is an abrasive final finishing process that generates an ultra-fine, controlled microinch finish. It removes grinding flats, feed spirals and corrects geometrical errors — all at the same time.

Taft-Peirce/Supfina attachments set up quickly and easily on lathes and other machine tools. They are completely portable and no special skills are needed to operate.

Many opportunities for finishing short-cuts: elimination of surface grinding, salvaging of rejects, out-of-roundness correction. Supfina does its job extremely fast and desired finish is attained in a matter of minutes.

Save with Microstoning! Whatever your present finishing system, look into Taft-Peirce/Supfina Microstoning. Send for complete details, now!

Finish it with



SUPFINA

7 MECHANIC AVE., WOONSOCKET, R. I.

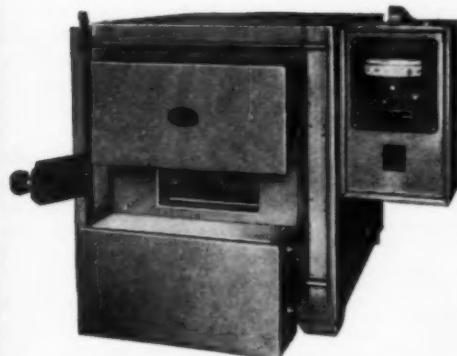
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799-21



**SPARROW III**, an air-to-air missile described in "Nose Cones—A Study In Grinding Technique" in the June issue of **MACHINE & TOOL BLUE BOOK**, is shown here mounted underneath a U.S. Navy McDonnell F3H-1 Demon Aircraft. Developed and produced by Raytheon Mfg. Co., this electronically controlled missile can be fired with great aiming leeway because in flight it acts for itself and has the ability to track down and destroy its target. Interest in the appearance of the SPARROW III was generated as a result of an artist's conception of a missile, which unfortunately looked more like the HONEST JOHN missile. The SPARROW III is about 12' long, 8" in diameter, and weighs about 350 pounds. • • •

## PRODUCTION SHORT-CUT IDEA



An all-new TEMCO electric furnace specifically designed to let you heat-treat more **and bigger** parts in a bench-type unit. **Larger chamber size . . . 10" W, 9 1/2" H, 22" D. Higher temperature range . . . continuous up to 2000° and 2300°F (1095° and 1260° C) . . . handles most high-speed steels.**

This new Type 1800 TEMCO furnace features a close-sealing sectional door with patented lever suspension to provide limited or full access as desired. Reinforced welded steel case . . . 7 1/2" firebrick and backup insulation. Choice of single or three-phase models, for 208, 230 or 460 volts. Available with or without controls. \$685 to \$745 furnace only.

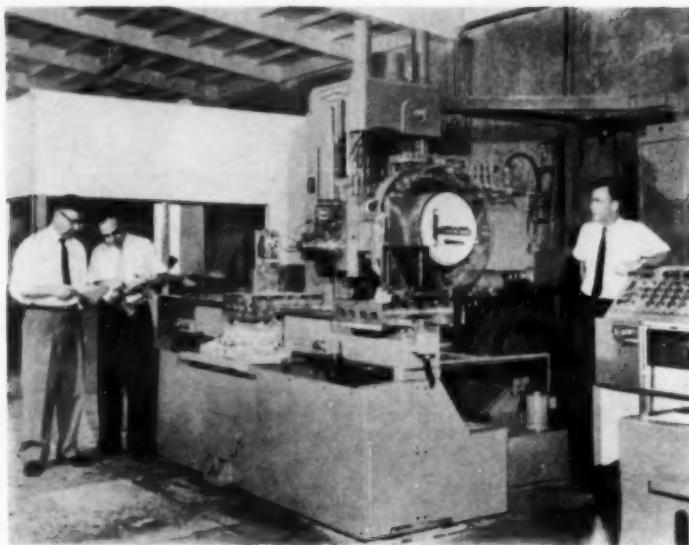
Write for free literature and name of nearest dealer.



**ELECTRIC FURNACES**  
**THERMOLYNE CORPORATION**  
(formerly Thermo Electric Mfg. Co.)  
486 Huff Street, Dubuque, Iowa

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## New West Coast Job Shop Offers Advantages Of Manufacturing With Numerical Control



Three Mill-A-Matic officers look over operations in the new plant. Secretary-treasurer Bob Knutson, left, and vice-president Lloyd Maxwell, check finished part with engineering drawing. Production manager Wanbaugh, right, supervises Milwaukee-Matic operation.

Recently, a new concept in job shop operation, Mill-A-Matic Machining, Inc. opened for business in Santa Ana, Calif. This new manufacturing concept employs a numerically-controlled Kearney & Trecker Milwaukee-Matic to automatically produce small or medium-lot jobs requiring a variety of machining operations for industrial customers.

Vaughn Clark is president of the new organization.

With this highly versatile machine, Mill-A-Matic offers a complete manufacturing service—producing finished parts or products faster and at lower cost than with any combination of conventional machine tools. Milwaukee-Matic operates completely automatically under tape control. It is

a complete machining center in itself—automatically combining milling, drilling, boring, reaming, tapping and other similar operations into a single integrated unit.

While more than 50 of these machines are now being used by manufacturers in the production of their own products, this is the first time a Milwaukee-Matic has been selected as the basic manufacturing center by a job shop.

The service that Mill-A-Matic offers industry goes beyond the machining of individual parts. It is equipped and staffed to offer a complete manufacturing service from engineering to finished products—including assembly of parts, painting, packaging and warehousing, if desired.

## Fluid Power Society Holds Annual Meeting, Oct. 16

Applications for membership in the recently organized Fluid Power Society are being received at a very gratifying rate. Along with individual applications, there are many requests for information on the organization of local chapters. It is expected that by the end of 1961, there will be local units in all of the principal cities of the United States and Canada.

The First Annual Meeting of the Society will be held Wednesday, October 19 at the Hotel Sherman, Chicago. This is the day before the 16th National Conference on Industrial Hydraulics to be held at the same location and was purposely selected to enable interested persons to attend both meetings.

In addition to a general session to be held in the afternoon, there will also be a meeting of the House of Delegates and the Board of Directors.

Non-members of the Society are invited to attend the general session, without payment of registration fee, so that they may become better acquainted with the Society, its purposes, operations, and benefits.

Contact F.P.S. headquarters, 5595 N. Hollywood Ave., Milwaukee 17, Wis.

## National Fluid Power Assn. Meets Oct. 31-Nov. 2 In Chicago

The 1960 Fall Meeting of the National Fluid Power Association will be held October 31-November 2 at the Edgewater Beach Hotel in Chicago. Emphasis for the meeting will be on marketing and technical subjects. In addition to the above activities, there will also be reports and discussions by the Management Services Board and the Public Relations Board.

Instead of following the format of past programs, which usually scheduled several speakers from within and without the Association, the Marketing Board has arranged for a series of

## Accurate Clearance from O.D. to WEB...



### Model "DV"

Grinds ALL drills  $\frac{1}{8}$ " to  $2\frac{1}{2}$ ", 90° to 140° included angle, 2-3 or 4 lips.

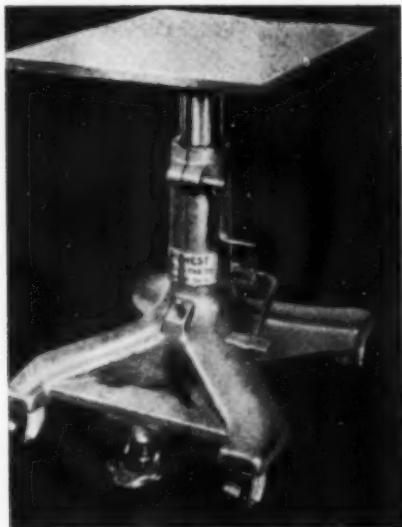
SIMPLE, positive adjustments with built-in direct reading gauges allow accurate setting of clearance angle and included angle. Grinding action generates a true conical clearance angle that is constant from O.D. to web. Drill enters work easier, cuts freer, produces more holes per grind. Set-ups are fast because no chucks or collets are used. Locating on lip being ground produces accurate centering.

For a LOW COST Drill grinder with BIG CAPACITY ask your distributor about the STERLING Model "DV" or write for complete information.

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2000 LBS. OR \*1000 LBS. CAPACITIES  
\*ILLUSTRATED

## A precision made MIDWEST TABLE Costs no more!

- ✓ It's hydraulic . . . positions work or feeds at desired height without use of hands
- ✓ Rigid cast construction
- ✓ Top turns 360° and clamps
- ✓ Foot release valve to lower
- ✓ Machined top surface can be used as work table
- ✓ Roller bearing casters with ball bearing swivels
- ✓ Floor clamping available extra

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MANUFACTURING COMPANY  
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workshops covering such subjects as Manufacturer-Distributor Relations, Appraisal of Industry Markets, Product Planning, Advertising and Sales Promotion, Sales Management, Marketing Administration, and Statistical Service.

The Technical Board program will be built around the theme of "Rating Methods," with separate workshops for manufacturers of pumps, valves, cylinders, accumulators, and fluid conditions. At its general session reports will be presented on classification index system, fluids, terminology, and publications.

In order to allow maximum time for workshop sessions, marketing and technical workshops will be held concurrently.

Representative of manufacturers of fluid power components not members of the Association desiring to attend the fall meeting are requested to contact Barrett Rogers, National Fluid Power Assn., 5595 N. Hollywood Ave., Milwaukee 17, Wis.

## Optical Gaging Products, Inc. Establishes West Coast Facility

Optical Gaging Products, Inc., a subsidiary of the Ex-Cell-O Corp. of Detroit, has opened a West Coast branch to manufacture chart-gages and to offer engineering services in the field of optical gaging. The new quarters will be located in the Ex-Cell-O Corp. plant at 12200 S. Bellflower Blvd., Downey, Calif.

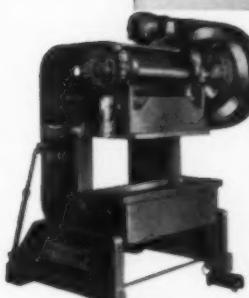
This new facility will prepare master chart-gages, layouts, and precision duplicates. It is equipped and staffed to give "on-the-spot" service to West Coast industry. John K. Witte is manager of the operation and moves with his family to Los Angeles after 20 years of experience with Optical Gaging Products, Inc., at Rochester, N.Y.



### Storage Center Carved Out of Rock

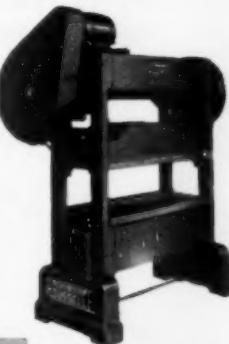
Manufacturers, perplexed by their bulging office files and alerted to a greater concern for the safety of their vital records by the Sputnik-H bomb era, are showing a lot of interest in the recently opened records centers 650 feet beneath the Kansas prairie in a salt mine at Hutchinson. The underground vastness of Underground Vaults & Storage, Inc., the records storage center, is conveyed in this photo—a time exposure down one of the many main corridors in the mined out portion of the Carey Salt Mine beneath Hutchinson, Kans. Twelve huge rooms can be seen branching off the main corridor to the left, each the size of a football field.

## High-Output with **Rousselle** DOUBLE-CRANK PRESSES



No. 4B OBI with  
"Econo-Air" clutch.

**SPEED UP PRODUCTION** with these versatile 40-ton presses. Large bed and ram areas make them ideally suited to handle wide rolls or sheets . . . do multiple punching, steel-rule die work and other high output operations. For rapid, shockless starting and stopping, presses can be equipped with electrically controlled "Econo-Air" friction clutch . . . Ask for new catalog.



**STRAIGHT SIDE** — Die space up to 24 in.; bed space up to 6 ft. between uprights.



Choice of over 30 models and types in 5 to 60-ton sizes

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Rousselle Presses are sold exclusively through Leading Machinery Dealers.

## Burg Tool More Than Doubling Its Plant in Gardena

Burg Tool Manufacturing Co., Inc., Gardena, Calif., is expanding its present manufacturing facilities by 31,520 sq. ft. The addition will provide new general offices, machine assembly area, and also house the Burgmaster Division which manufactures and distributes the Bench Model six-spindle turret drilling and tapping machine. The present office space will be utilized by the Sales and Engineering Departments.

In addition to the building, several new machine tools are purchased as a part of a modernization program. These include a Norton external grinder, a Heald internal grinder, a Kent-Owens automatic hydraulic mill, a special three-spindle Wisconsin boring machine, a multi-spindle horizontal boring machine, a De Vlieg boring machine, and an Ingersoll planer-type milling and boring machine.

Several new Burgmaster drilling, tapping and boring machines are also added, including 2BH and 3BH automatic six and eight spindle turret drilling machines, and 2BHT and 3BHT tape controlled six and eight spindle turret drilling machines will be in operation.

## Thermo Electric Changes Names

The corporate name of Thermo Electric Manufacturing Co. has been changed to Thermolyne Corp. The new name—Thermolyne (rhymes with "line") Corp.—will better distinguish and identify the company, eliminating confusion with similar sounding names and trade styles.

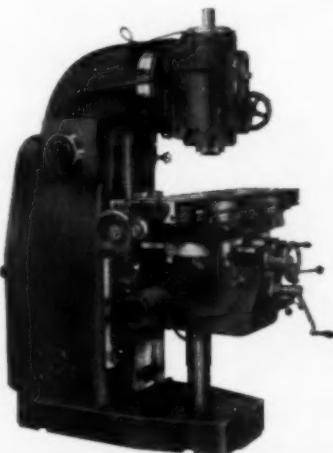
Nothing has been changed but the name. The Dubuque, Iowa, firm will continue to manufacture furnaces, temperature controlling and indicating instruments, laboratory hot plates, magnetic stirring hot plates, etc., under the Temco and Thermolyne trademarks.

## POWER PERSONIFIED SAJO No. 2 Vertical Miller

Just a glance at this rugged machine confirms its ability to perform with ease the most demanding jobs. Sajo's swivelling head, power feed to quill and unrivaled spindle construction combine versatility with unsurpassed tool room accuracy.

Also available —  
Horizontal Millers  
Plain and Universal

No. 2 Vertical Miller  
table size: 52" x 11"  
7½ and 1½ HP motors  
rapid power traverse



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## Hill Acme Purchases Kling Bros. Products

J. B. Perkins, president of The Hill Acme Company, a 75-year-old Cleveland manufacturer of heavy and special machine tools, wishes to announce that, as part of their expansion program, they have purchased outright the entire product line of the **Kling Brothers Engineering Works** of Chicago, Ill. The following Kling products will be manufactured, distributed, and serviced from the Hill Acme Co. plant located in Cleveland, Ohio: combination punch and shears, rotary shears, high speed friction saws, pyramid bending rolls, universal punches, double-angle shears, guillotine shears, angle bending rolls, and pinch plate rolls.

The Kling Brothers Engineering Works is a 68-year-old Chicago machine tool builder. This company has serviced the following industries over

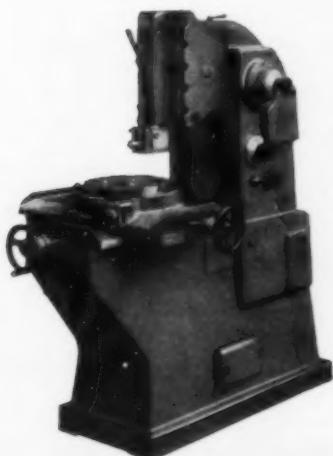
the years: steel warehouses, ship-builders, steel mills, and the general metalworking industry.

## Marshall Steel Assets to Henry G. Thompson & Son

The Marshall Steel Co. has contracted to sell all of its assets to the **Henry G. Thompson & Son Co.** of New Haven, Conn.

The Thompson Co. is well known in the industrial distribution field. The firm manufactures the Milford brand of hack saw blades and band saw blades.

The Marshall Steel Co. will be operated by its present management and personnel. The quality of Marshall ground flat stock and drill rod will be maintained without deviation. Inventories and service will be continued as heretofore. The same sales personnel will continue to serve.



## SPEED AND FLEXIBILITY

### — with cost-cutting Vertical Shapers

Easily set up and using the simplest tooling, the CHOMIENNE M-5" with its combination of longitudinal, transverse and rotary table movements, angular ram adjustment and ram speeds up to 270 strokes per min. solves production "problems."

Also available —

Vertical Shaper, 12" with

28½" Rotary Table, 5 HP motor.

Horizontal Shapers, plain and universal

12" to 30" stroke, 2 to 10 HP motors

5" Vertical Shaper  
12½" Rotary Table  
2 HP motor



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## **PORTABLE HONES**

**SAVE MANY HOURS IN PRODUCTION,  
SALVAGE, JOB LOT, MAINTENANCE  
AND TOOL ROOM**

More than 100,000 satisfied users testify to the utility of these "Tools of a Thousand Uses" for internal diameter work in nearly all materials.

Sunnen Portable Hones are guaranteed to produce geometrically round, straight bores — accurate within .0005" — with any desired cross-hatched, lubricant-retaining finish.

Corrects Errors

Exact Size Control

Controlled Finish

Fastest Stock Removal

Positive Adjustment

Portable, Yet Rugged

Operates in any Position

Your Sunnen Field Engineer will be glad to help you solve your sizing problems at no obligation to you.

SN-75 Midget Hone	Range 1 3/4" to 2"
JN-95 Junior Hone	Range 2" to 2 1/2"
AN-112 Standard Hone	Range 2 1/2" to 7"
AN-812 Heavy Duty Hone	Range 4 3/4" to 20 1/2"

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## **Bryant Computer Products Division Moves Headquarters**

An announcement by H. G. Bixby, president of Ex-Cell-O Corp., Detroit, states that Bryant Computer Products has become a division of Ex-Cell-O, and that the management, sales, product engineering, research and development activities of this division have moved into a new building at the **Ex-Cell-O Technical Center**, Walled Lake, Mich.

These changes permit an expanded research and development program at Walled Lake, close to Detroit's reservoir of skilled electronic and mechanical engineering talent. The manufacture of magnetic storage drums and associated products for computers and guidance systems will continue in Springfield, Vt.

## **Speed-D-Burr Corp. Sells Stock to Forrest Hinckley**

The Speed-D-Burr Corp. of Glendale, Calif., announced the purchase of its majority stock by **Forrest F. Hinckley**. Hinckley, formerly vice president of **Aeroquip Corp.** and general manager of its Western Division, will act as president of Speed-D-Burr. Speed-D-Burr's two modern plants are to be streamlined for increased production.

The manufacture of Speed-D-Burr equipment will continue to be done at the Wilmington Plant, 231 E. Lomita Blvd., while the majority of deburring, burnishing, and surface finishing will be handled in Glendale at 3613 San Fernando Rd.

**"Jorgensen"**

and

**"Pony"**

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**ADJUSTABLE CLAMP CO.**

the clamp folks

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Send for  
**FREE**  
32-page  
catalog show-  
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### Elgin Abrasives' Distributor

The Abrasives Division of the Elgin National Watch Co., Elgin, Ill., has announced that sales of its solid carbide rotary cutting tools will be handled through industrial distributors in the future. Previously, sales had been handled on a direct basis.

Appointed as district managers to work with the distributors are Donald Bennett of Elgin and Robert D. White of Long Island, N.Y. Bennett will cover the Midwest and White the East Coast.

### Murdock Appointed Distributor For Atrax Carbide Tools

The Atrax Co., Newington, Conn., has announced the appointment of Murdock Tool Co., 1747 Abbott St., Detroit, WOodward 1-8739, as its stocking distributor in Southeastern Michigan. Murdock will service Atrax customers in Detroit, Dearborn, Ann Arbor, Ypsilanti, Lansing, Wyandotte, Royal Oak, Jackson, Pontiac, Monroe, Mt. Clemens, Port Huron, Willow Run, Livonia, and surrounding areas.

## ETALON INGAGE

measures the  
exact BORE or  
blind hole size!

Reading: .0001"

Size: 3/16" to 4"

Takes accurate measurements of blind holes. No masters or setting rings—measures directly—by .0001".

Automatic alignment, rectangular contact points guarantee extreme accuracy even when fully extended. Immediately detects out of round holes. with extensions measures holes up to 6 feet deep. Hardened contact points exert minimum pressure—will not damage fragile work.

Easy to read, deep graduations on a large diameter thimble. Dull chrome plated. Furnished in English or Metric graduations individually or in sets.

WRITE FOR CATALOG on complete line of precision measuring instruments VERNIER CALIPERS, MICROMETERS, DIAL INDICATORS.

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## Appointments and Promotions

### Personnel Changes . . . Executive and Production



H. T. Florence



J. Mercier



J. W. Dopp



C. N. Hall

**Herbert T. Florence**, who started with the company as an apprentice 37 years ago, has been elected president and general manager of The Cleveland Crane & Engineering Co., Wickliffe, Ohio. He succeeds **Charles F. Safreed** who has been made chairman of the board. Also advanced were **William J. Ryan**, who became vice president and assistant general manager, and **Ralph Ford**, plant superintendent, who was made assistant secretary, in addition to his present position. New directors to the board were also named . . . **Jean Mercier**, president; **Stephen Polanski**, vice president and general manager; **David Fremson**, vice president and secretary, and **Alec Ullman**, treasurer, are officers of a new company, Olaer Products, Inc. of Westbury, L. I. The firm has been established to supply engineering, service, and prototype facilities in the areas of hydraulic, pneumatic, and electrical components and systems. Mr. Mercier is well-known for his many inventions in the hydraulic-pneumatic field . . .

**Maurice Gormly** has been appointed the new manager of the Products Division of The Cincinnati Milling Machine Co. He succeeds **Philip O. Geier, Jr.**, who is now vice president and assistant general manager of the firm . . . **Lapointe Machine Co.**, Hudson, Mass., exclusive U.S. representative for a number of British manufacturers of precision machine tools, announces the appointment of **James W. Dopp** as vice president. He will continue to serve as sales manager for the company . . . Several changes in the official staff of **Ex-Cell-O Corp.**, Detroit, are now effective: **Earl E. Conlin**, secretary and treasurer since 1951, has been elected vice president for finance; **Miles H. Knowles**, now secretary, will retain his duties as general counsel of the corporation; **Edward J. Giblin**, formerly assistant secretary and assistant treasurer, has been elected treasurer. **Russell D. Hughes** has been appointed controller, replacing **Roland C. Stein**, who retired in September . . . **Charles N. Hall** has been named chief



C. F. Safreed



M. Gormly



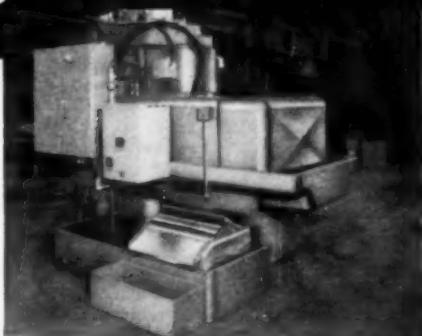
E. E. Conlin



F. P. Hauck

# 432 MILLION GALLONS of CLEAN COOLANT PER DAY!

● That, roughly, is the potential capacity of the over 10,000 successful BarnesdriL Magnetic Coolant Separators, Filters, and Kleen-all Filter-Separator installations now in use. Contaminated coolant on your grinding, honing, broaching, gear shaving, and/or polishing operations may be causing excessive rejects . . . unnecessary wheel dressings . . . poor finish control . . . increased machine wear . . . frequent waste of coolant that could be reclaimed. BarnesdriL coolant cleaning units pay for themselves in a short time. There's a model just right for your shop — capacities range from 1½ to 120 GPM. Write for free literature, or ask to have a BarnesdriL representative call!



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October, 1960

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Catalogs 100A and  
300D covering Barnes-  
driL coolant cleaning  
equipment.

217



R. C. Dickey



V. Marsh



J. R. Patterson



R. G. Schneider

grinding engineer for The Heald Machine Co., Worcester, Mass., succeeding **Clifford G. Menard** who has been named consulting engineer for the Engineering & Research Departments . . . **Fred P. Hauck** has been elected executive vice president and **Robert C. Dickey**, vice president in charge of manufacturing, at Michigan Abrasive Co., Detroit. With this appointment, Dickey retains his post as vice president and general manager of Coated Abrasives, Inc. . . . **Fred S. Haas, Jr.**, who has represented the company in southern Ohio for many years, has been appointed Chicago district manager for Standard Tool Co., Cleveland. He succeeds **Ben McConnell** who has resigned . . . **Vernon Marsh**, with over 20 years' experience in production and manufacturing methods, has been named factory manager of the American Pulley Co. plant in Philadelphia. . . . Sun Oil Co. named **William A. Romeiser** general manager of its industrial products department with headquarters at the firm's Philadelphia general offices. He succeeds **Francis F. Palmer**, currently retail sales manager in the company's Ohio Valley sales region. . . . **Robert Potter**, formerly president of the E. W. Bliss Co., Canton, Ohio, was elected chairman of the board of directors, and **J. Ralph Patterson**, formerly vice president in charge of the company's Mackintosh-Hemphill Division, was elected to the office of president and chief executive officer. Patterson was also elected a director of the company at the same time. **Belmont Pinney** has been appointed to the new position of assistant division manager, Hastings, Mich. Division of the E. W. Bliss Co.



F. S. Haas, Jr.



R. Potter



B. Pinney

## Sales and Service

**R. G. Schneider** has been appointed manager of engine lathe sales for the R. K. LeBlond Machine Tool Co. of Cincinnati. He was formerly field sales and engineering manager for the J. H. Elliott Co. at Washington, D. C. . . . **W. S. Hoskin**, formerly general sales manager, has been elevated to the post of vice president in charge of sales for Michigan Abrasive Co., Detroit. **Ken C. Davis**, formerly assistant general manager, has been moved up to the post of



W. S. Hoskin



K. C. Davis



W. S. Boice



T. S. Iams



L. S. Sternal

general sales manager . . . **Willis S. Boice**, formerly assistant sales manager of Boice-Crane Co., Toledo, has been promoted to sales manager . . . **Taylor S. Iams** has been named sales engineer

for the Pittsburgh area for the Macklin Co. of Jackson, Mich. He is a director and board chairman of the Unifab Co.

. . . **L. S. Sternal**, with an extensive background in the coated abrasive and finishing industry, has been named the company's sales manager for Timesaver Sanders, Minneapolis . . . **Edward R. Burkhardt**, vice president-tool sales, has announced the appointment of **Thomas M. Sweeney** as field sales manager-Tools Division for the J. H. Williams & Co., Buffalo . . . **John A. Menster** has been named manager of welded tubing sales for The Babcock & Wilcox Co.'s Tubular Products Division, Beaver Falls, Pa. He succeeds **Leon E. Jeanneret**, retired.

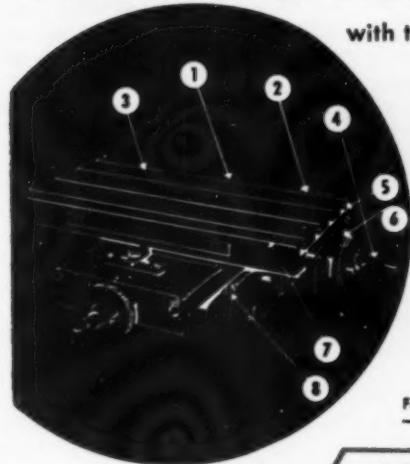


T. M. Sweeney



J. A. Menster

**SAVE... 10-60% on Multiple Radii and Angle Milling**



with the

# COOK

PRECISION  
*Cross Slide Table*

1. Lightweight Meehanite Castings
2. All Ways and Gibs are hand scraped
3. Top and Bottom are precision ground
4. Heat treated lead screws with 2 1/2" bronze nuts reduce backlash to a minimum
5. 4 Tee Slots with 8" scales on each slide
6. Dials graduated from .001"-.50" per revolution
7. TOP 8" x 12"; Length 15"; Ht. 4"; Wt. 60 lbs.
8. Locking device eliminates chance of table moving

For all precision work on Mold Cavities — Plungers — Dies — Templates and other intricate milling.

**LAWRENCE H. COOK, INC.**

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# PUSH BUTTON *Speed Selection* from to in seconds



or to any intermediate speed, instantly

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth

power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

## SHELDON *Variable Speed* PRECISION LATHES



Write for

"Variable Speed" Circular and General Catalog showing . . .

• 10", 11", 13" and 15"  
SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)

• 13" and 15"  
SEBASTIAN Geared Head Lathes

• SHELDON Milling Machines

• SHELDON Back Geared Shapers

**SHELDON MACHINE CO., INC.**

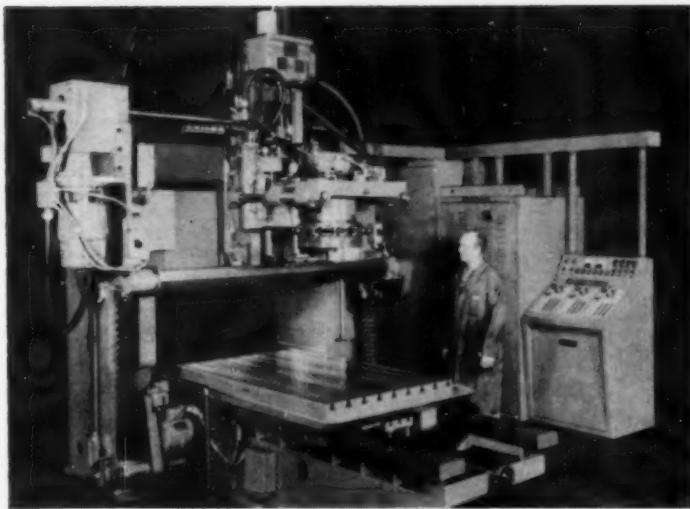
4242 N. Knox Ave.

Chicago 41, Ill.

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# what's new in metalworking

15



## NUMERICALLY CONTROLLED MACHINE WITH 20 UNIT AUTOMATIC TOOL CHANGER

The new vertical spindle rail type Model 21 has numerical control covering a three-axis range of 60" table travel, 40" head cross travel, and 24" head vertical stroke. The 66½" x 44" table positions at 150 ipm and feeds at rates infinitely variable between 4 and 150 ipm. The horizontal rail has 28" vertical adjustment from 4" to 32" above the table, with 40" cross travel. Cross travel positioning rate is 150 ipm, with feed rate infinitely variable between 4 and 150 ipm. A total vertical head stroke of 24", including 12" feed stroke, is the third axis. Vertical feed rates are from  $\frac{1}{2}$  to 150 ipm. The vertical spindle operates in three speed ranges from 105 to 2000 rpm with automatic shift between ranges.

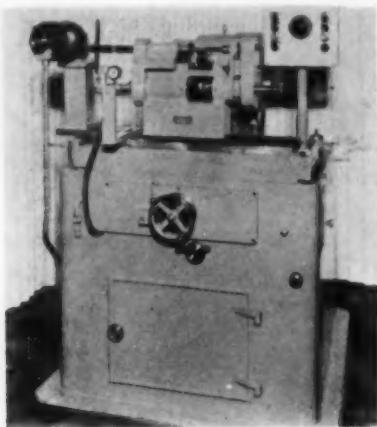
A 20 unit automatic tool changer enables the machine to perform a great variety of operations. The numerical control system provides continuous automatic cycles including positioning, feeds, speeds, and tool selection. Standard control components provide manual operation of all functions.

Sundstrand Machine Tool, Belvidere, Ill.

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## Throw-Away Tool Grinder Regrinds Used Tools

This cam-type throw-away grinder is reported to grind any type tool such as triangles, squares, diamond shape, hexagons, pentagons, rounds, and rectangles. It is stated the machine will grind all radii perfect tangent with sides and hold apex within .0005, all radii being held within .001 of shape. Inscribed circles and distance across



radii are also held uniform and within .0005.

The machine will grind positive and negative angle tools.

Tools ground are said to be very sharp and smooth, and seem to have a honed edge due to the wheel traveling in the same direction as the edge of tool. Used tools can be reground economically, in some instances with a reported 30% more service from a reground tool than from the original conventional ground tool due to smooth, sharp grinding.

The machines are fully automatic after loading. One man can operate up to three machines.

**The Harvill Machine Co., P. O. Box 88, Hazel Park, Mich.**

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A new feature—constant-positive hydraulic feed with dial set.

## Hydraulic Unit Drills & Taps 1 1/4" In Steel

A new heavy duty Model 25AH automatic hydraulic Burgmaster six-spindle turret drilling machine is used for precision drilling, reaming, tapping, boring, counterboring, etc., without guide bushings. Driven with 7 1/2 hp motor, machine has 1 1/4" capacity in steel and speed range of 90-3000 rpm; throat depth, 17-3/16"; turret travel, 10", and new optionals.

New individual features reported include: constant-positive hydraulic feed with dial set; direct reading electrical feed indicator; automatic temperature and pressure compensation of hydraulic feed to insure accurate feed rates under all conditions; turret clamp employs V-type automatic clamping ring for increased turret rigidity, etc. New optional extras include a four-speed motor drive providing 24 speeds in three ranges of eight speeds per spindle, from 90-3000 rpm.

Individual spindle speeds, feeds, and depth of cuts are preselective and quickly adjusted.

**Burg Tool Manufacturing Co., Inc., 15001 S. Figueroa St., Gardena, Calif.**

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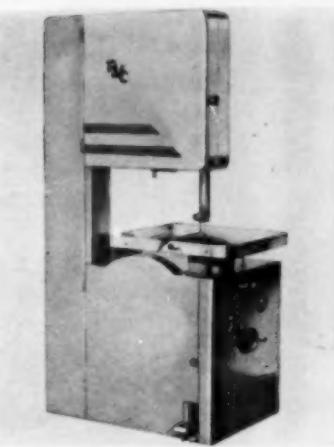
**Contour Saw Has  
26" Throat & 15" Height Cap.**

The new contour saw, with 26" throat capacity and 15" height capacity, features an infinitely variable speed drive from 50 fpm to 6000 fpm which is tachometer controlled. It has a 24" x 28" table which is adjustable 10° left and 45° right. Hardened saw blade guides are replaceable and can be adjusted for blades from 1/16" up to 1/2" wide. An air stream keeps chips away from the work.

The Model 2600 contour saw accommodates blades with a maximum length of 187 1/2" and a minimum length of 180".

The price of the new saw, less electrical, is \$1325.00; and \$1550.00 complete with electrical equipment. Various other accessories are available.

Peerless Machine Co., 1600 Junction Ave., Racine, Wis.



Contour saw features infinitely variable speed drive from 50 to 6000 fpm which is tachometer controlled.

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## ALLEN Heavy Duty PUNCH PRESSES

Model BT-25  
25 Ton—\$1997.50  
less motor—\$68



Model BT-12  
12 Ton—\$437.50  
less motor—\$68



Model BT-8  
8 Ton—\$347.50  
less motor—\$68



Model BT-5  
5 Ton  
\$199.50  
less motor—\$68

Model B-2—2-Ton  
\$57.50  
less motor—\$68

**Powerful  
Dependable  
Economical  
Fully  
Guaranteed**

Check the Yellow Pages  
of Your Phone Directory

**Hundreds of different  
Model Combinations  
1 to 25 ton Capacities  
Moderate in price**

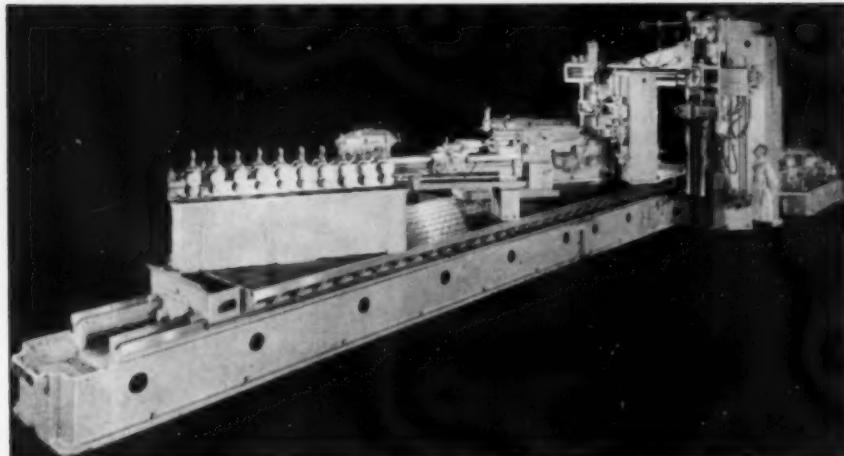
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plete information, specifica-  
tions and prices on our line  
of Heavy Duty Punch Presses.  
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**ALVA ALLEN INDUSTRIES, Dept. MTB**

Clinton, Missouri · Tel. TURner 5-3331

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## 72" x 72" x 34' Rockford Hy-Draulic Openside Planer



Four machines—a roll forming machine, a lathe, and two shapers—12 tons in weight, demonstrate the planer's over-all size.

Believed to be the world's longest hydraulic planer, this new machine has a table working surface 34' in length. Four machines—a Maplewood OG-10 roll forming machine, a Rockford economy lathe, a Rockford ram-type shaper, and an openside Hy-Draulic shaper—with a combined weight of over 12 tons, placed upon the table, demonstrate its tremendous over-all size.

Because the planer is hydraulic, it is easy to operate. The operator completely controls the huge machine directly from the pendant. The big table may be started, stopped, inched, or jogged in either direction, or any speed range can be instantly selected and the exact cutting speed infinitely adjusted, all at the pendant. Complete positioning of the toolheads, selecting feed or traverse and amount of feed desired, main motor and rail elevation, are all pendant controlled.

The manufacturer states the Hy-Draulic H-3 triple circuit drive affords extraordinary efficiency and versatility to every type of planer work, providing the exact combination of cutting speeds and cutting force needed to most

economically plane every type of metal from the free-cutting to the toughest types. Because it contains no bearings, gears, links or joints, finer finishes are possible with Hy-Draulic drive.

Built for greater precision and more extensive use of carbide tools, this new model has many Hy-Draulic design and safety features.

This model is also manufactured in 36" x 36", 42" x 42", 48" x 48", and 60" x 60" sizes, with conventional or H-3 triple circuit Hy-Draulic drives.

Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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## Tungsten Carbide Rotary Files Incorporate New Design

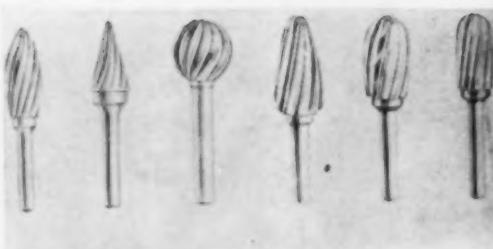
A new design feature for tungsten carbide rotary files is said to increase their life and efficiency up to 25 times. The files embody a special, second "trailing" edge built into the length of each tooth, greatly increasing the overall strength of each flute and resulting in speedy, smooth stock removal. Chip-loading and build-up of edges is also

reported greatly reduced. The design also permits reduction in the number of flutes, giving better bite.

Like all tungsten carbide rotary files, facet tooth files will have optimal efficiency at high or ultra-high speeds on all types of metals, but because of the new design can be used effectively at lower speeds.

Grobet File Co. of America, Inc.,  
Carlstadt, N. J.

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Facet tooth file sizes and shapes.



**dust  
collection—  
simplified!**

Now, with more than fifty models in the Dustkop line—plus efficient accessory items—the odds are that a standard unit will solve your problem. Dustkop units solve other problems too. They're easier to install, save space and money and are virtually maintenance-free!

#### **how to select a dust collector**

This new brochure includes all basic information needed to select the right dust or mist collector for grinding, buffing, polishing and other types of service. Write for your copy. No obligation.



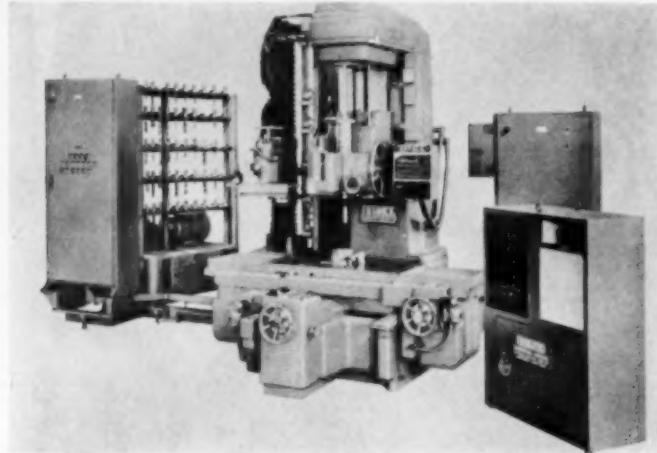
**AGET** Manufacturing Company  
1402 Church St., Adrian, Michigan



**DUSTKOP STOPS DUST**

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## Boring Machine Has Tape Control and Automatic Tool Changing



Automatic tool changer on this Fosmatic holds up to 100 boring, drilling, and end-milling tools.

The new Fosmatic 54-P precision boring machine is illustrated, complete with tape control of saddle, table, spindle speeds and feeds, spindle depth, head, and automatic tool changing. The Fosdick tape control system is electro-mechanical with all its off-machine components housed in a single small console. It establishes head height and depth of cut through a built-in system of Class A gages similar to that used in the Fosmatic direct dimensioning measuring device. Head height and

depth control make it practicable to use tools of random length on a numerically controlled Fosmatic precision boring machine.

The automatic tool changer on this Fosmatic holds up to 100 boring, drilling, and end-milling tools. It is controlled from the same tape control console which positions and controls the machine.

Fosdick Machine Tool Co., 1638 Blue Rock St. Cincinnati 23, Ohio.

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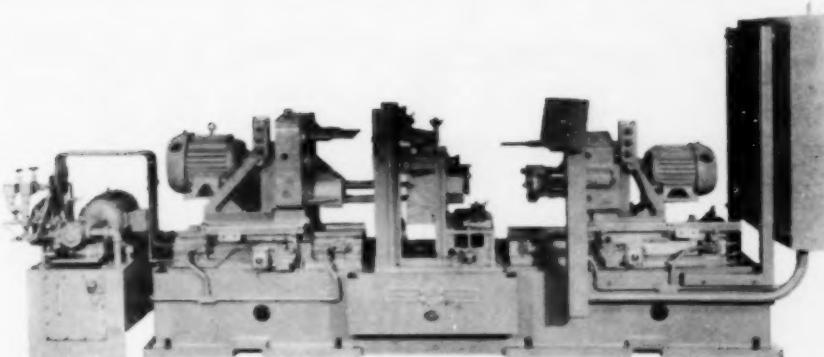
## Comparator & Surface Finish Indicator

This electronic transistorized comparator makes use of four pen lite batteries which can be purchased in a drug store and has a reported life of approximately 200 (200 hours, range .006 from 0 center  $\pm .003$ , first setting, .001 graduation, second setting, .000010). The electronic circuit is designed with an additional probe specifically for surface finish in microinches. Unit makes use of printed circuit wiring. Priced under \$250.00.

Taper Micrometer Corp., 100 Grove St., Worcester.

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With a two-position fixture, the machine drills automotive intake manifolds.

### Two-Way Single Station Drilling Machine

Machine Serial 1311 is a horizontal 2-way single station drilling machine with a 2-position fixture for drilling automotive intake manifolds.

Two R-J 10" hydraulic way type units are mounted opposed. One unit is equipped with a 10-spindle head and the other unit with a 5-spindle head.

Operations are performed on the part

piece in each of the two positions of the fixture. The fixture is arranged for manual clamp and unclamp of the part in each position of the fixture.

Production of the machine is approximately 60 parts per hour gross.

Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.

Use postpaid card. Circle No. 73



## FLANGING MACHINES and CIRCLE SHEARS



**No. 1** 10 Ga. Circle Shear and Flanger.

**No. 3**  $\frac{1}{4}$ " Cap. Flanger for flat heads.

**No. 4**  $\frac{3}{8}$ " Cap. Flanger for flat and dished heads.

**No. 5**  $\frac{1}{2}$ " Cap. Flanger for flat and dished heads.

**No. 6**  $\frac{5}{8}$ " Cap. Flanger for flat and dished heads.

**No. 7**  $\frac{3}{4}$ " Cap. Flanger for flat and dished heads.

**No. 60**  $\frac{3}{8}$ " capacity circle shear with a 23" throat.

**No. 40**  $\frac{1}{4}$ " capacity circle shear with a 15 $\frac{1}{2}$ " throat.

Shown is Model No. 56 Elliptical Head Shear and Flanging Machine which operates from the same controls. Head is sheared to size and shape before flanging from same template without removing work from the machine.

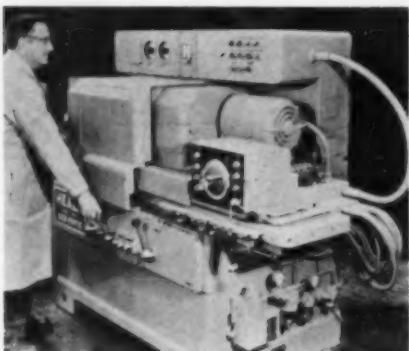
**BLUE VALLEY** MACHINE & MFG. CO.  
6832 Truman Road KANSAS CITY 26, MO.

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October, 1960

**Increased Workhandling Cap.  
And New Feed Control Featured**

It is claimed impulse feeding makes possible straighter bores with smoother



Wheelhead is mounted directly on the cross-slide and feed is accomplished by moving the wheelhead into the work. This arrangement permits heavier roughing cuts, with minimum of distortion.

finishes for long bore ratios on Heald's new Model 171A integral grinder.

The wheelhead is mounted directly on the cross-slide and feed is accomplished by moving the wheelhead into the work. This contrasts with previous Model 1 designs where the workhead was mounted on a cross-slide and fed into the grinding wheel. The new arrangement permits heavier roughing cuts with a minimum of distortion, more accurate and faster feeding, and improved tolerance control.

The manufacturer also reports that workpieces to 8" O.D. (10" O.D. in special cases) can be accommodated. The new machine also has greater angular capacity, taking work with a 90° included angle. Previous models handled up to 60° of included angle.

Either constant or impulse feeding can be selected through the feed box. Infinitely variable compensation for wheel wear (from 0 to 0.004") aids in maintaining tolerances and promotes longer wheel life.

This grinder is also easier to operate. The feed box and wheel dresser ad-

# SUPER LOW-COST CUTTING

*Cut Pipes and Tubes*

*Fast—the Super-Speed*

*Rotary Way*

## CONTINENTAL ROTARY CUT-OFF MACHINES

**fast**—cut lengths in just seconds

**economical**—up to 100,000 cuts per cut-off wheel

**saving**—no waste loss of your material  
MACHINE RENTAL PLAN



*Continental*

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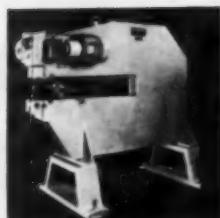
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Air or manual,  
3/8" to 12 1/4" O.D.  
Request Catalog.

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Combination shear,  
punch and coper



Shearing and forming machines



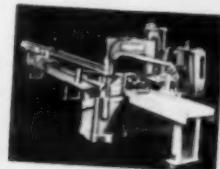
Arc welders



Roll forming machines



Power squaring shears



Hack saws



Bending rolls



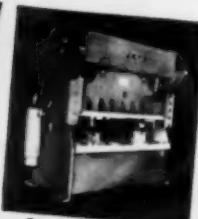
Hoists



Press brakes



Drill presses



Straight side presses



Rotary shears



Apron brakes



Bulldozers

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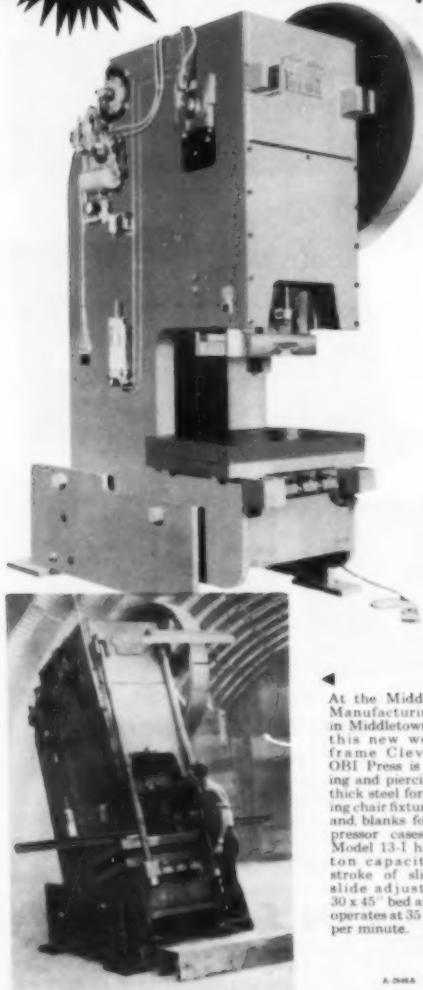
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...DOES TOUGH JOBS Dependably, Profitably

# CLEVELAND

**NEW** WELDED-FRAME COST-CUTTING *Open Back Inclinalbe* PRESSES



- Stronger structural frame—streamlined and built to withstand the shock and vibration of heavy-duty stamping.

Dies last longer with less downtime for die maintenance due to Cleveland's large box-type slide that results in greater production accuracy.

75 to 200-ton capacity, built for safer, more efficient operation with all gears and drive mechanism guarded.

Ruggedly built for many different press operations, material can be fed in from either side or from front to back.

Three different positions—vertical, 15° and 30°—to accommodate various types of dies and at the same time make use of gravity feed and discharge in automated production lines, or in operations using a single press.

You get better stampings for less with a CLEVELAND Press—the new welded-frame cost-cutting Cleveland OBI Press.

At the Middletown Manufacturing Co. in Middletown, Ky., this new welded-frame Cleveland OBI Press is blanking and piercing  $\frac{1}{8}$ -inch steel for reclining chair fixture parts and blanks for compressor cases. This Model 13-I has 150-ton capacity, 6" stroke of slide, 4" slide adjustment, 30 x 45" bed area and operates at 35 strokes per minute.

Write Today for  
Cleveland's OBI Press  
Catalog OBI 3-60



THE  
**CLEVELAND**  
PUNCH & SHEAR WORKS CO.

Established 1880

Power Presses  
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Punching Tools & Dies

E. 40th and St. Clair Avenue, Cleveland 14, Ohio

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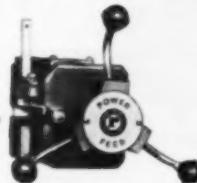
# NEW: W-T

WALKER-TURNER

## 20" 'POWER FEED' DRILL PRESSES

combine up-front control  
with one-hand operation

Every model in this new W-T "Light-Heavyweight" line (and there are 16 of them to fit your needs) offers a revolutionary new mechanical power feed with performance features NEVER BEFORE AVAILABLE on a standard drill press. Now you can do continuous, heavy duty production drilling faster, easier and with greater accuracy.



For unequalled flexibility—front mounted pilot wheel is mechanically integrated with clutch control to provide easy one-hand engagement of power feed; drill point pressure is infinitely adjustable from 0 to maximum capacity of machine; furnishes power and thrust for drilling 1" diameter holes, yet adjusts for use with  $\frac{1}{16}$ " bits.

For unmatched versatility—built-in control permits remote operation and can be electrically, hydraulically or mechanically interlocked with other units or synchronized with automation devices. Operator can utilize four feed ratios, drill manually, mechanically or in combination.

See your Walker-Turner Distributor (under "TOOLS" or "MACHINE TOOLS" in the Yellow Pages) for a demonstration. The only way to really appreciate the many outstanding features of these new W-T 20" 'Power Feed' Drill Presses is to see them *in action*. For FREE brochure giving specifications and information on how to adapt your present W-T 20" drill presses to 'Power Feed', write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WK-21, 400 N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.



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## How George Deickert upped grinding

Watchmakers have nothing on the builders of Marion power shovels as far as accuracy is concerned. Some of the shafts on Marion's biggest shovel (two full carloads in a single scoop!) have to be finished to a tolerance of  $\pm .0004"$  on bearing surfaces. The shafts run up to 12 ft. long and 14" dia. so the grinding operation alone is a substantial cost item.

That's where an outstanding Tool Control Supervisor like Marion's George Deickert is invaluable. His analysis showed five major deficiencies in the wheels used for the job and he quickly turned dissatisfaction into action. He called in Bay State Abrasive Specialist Dick Crofoot and Crofoot went to work with the engineering staff at Westboro. Result: a specification that did both grinding and finishing and ensured:

- (1) 30% faster stock removal.
- (2) Excellent instead of poor size control . . . easily within the  $\pm .0004"$  tolerance.
- (3) Consistent finish at 20 RMS.
- (4) 50% less dressing.
- (5) Greatly improved wheel life.
- (6) Consistent duplication of performance, wheel after wheel.

As George Deickert himself says: "We have dozens of different types of grinding jobs . . . and we use many different types of wheels, including tool wheels. Bay State not only does a lot of jobs for us and

does them well . . . they have also been able to duplicate excellent first performances with their follow-up wheels."

If your grinding operations . . . large, small or micro-miniature . . . are less than 100% efficient by current standards of abrasive technology, your Bay State distributor or direct representative is thoroughly trained and fully equipped to work out practical improvements for you. *Better grinding at lower cost . . . that is his business.*



One of the biggest excavators ever built, Marion Power Shovel Company's Type 5761 "Stripmaster" can dig 65 cu. yards at a time, fill two railroad cars with a single dipperful.



George Deickert, left, Tool Control Supervisor, and Melvin A. Griffith, grinding machine operator—Marion Power Shovel Co., Marion, Ohio—check progress of large, high carbon molybdenum steel shaft being ground by a Bay State cylindrical grinding wheel.

**speed 30% and cut dressings by 50%**  
**at MARION POWER SHOVEL**



George Deickert's background is impressive to put it mildly. His technical training started in Germany with a Masters Degree in steam and combustion engineering from Berlin University. His business career includes hitching with United Carbon Co., and Weston Instrument Co., in Newark, N. J. and fifteen years with Curtiss-Wright in Patterson, N. J. Starting as a Methods Engineer, he's been with Marion Power Shovel since 1947. He has used Bay State wheels since 1932 and says they have never let him down.

**BAY STATE  
ABRASIVES**

● Bay State Abrasive Products Co., Westboro, Massachusetts.  
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.  
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh.  
Distributors: All principal cities.



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# MORE CUTS PER WHEEL MEAN "MORE USE PER DOLLAR"



*With Faster, Cleaner*  
**MANHATTAN CUT-OFF WHEELS**

Every Manhattan Cut-Off Wheel is custom-bonded for the specific cut-off job—whether you work with hardened or soft steels, light gauge tubing, or critical alloys. And custom bonding means safe, fast, clean, cool cutting over sustained periods . . . saves you both time and money. Recent Manhattan developments in both rubber and resinoid bonds assure this greater cutting efficiency . . . and longer life for the wheels.

Manhattan Cut-Off Wheels are manufactured to meet your requirements in the widest range of types and sizes. Manhattan Abrasive Wheel engineers will assist you in selecting the exact construction to improve cut-off operations at your plant. They'll show you how you can save time and money . . . get "More Use per Dollar" . . . with Manhattan Cut-Off Wheels and other types of high speed, heavy duty wheels.

WRITE TO ABRASIVE WHEEL DEPARTMENT  
**MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY**  
**RAYBESTOS - MANHATTAN, INC.**

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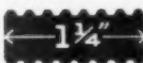
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RUBBER  
PRODUCTS  
...MORE USE  
PER DOLLAR

MACHINE and TOOL BLUE BOOK

Here are thread  and form  grinders



that give you toolroom precision plus  production line speed.

Plunge grind threads  long in a turn and a half 

or traverse grind long threads as fine as  60 pitch

And you have a choice of Crushtrue®  wheel dressing

(or multi-rib  or single-rib  diamond wheel-dressers) with

manual  or automatic  crushing. Furthermore, Crushtrue

dressing is ideal for grinding intricate profiles. 

Sheffield's versatile standard Thread and Form Grinders (Model 101, illustrated, capacity 7" diameter x 12" long; Model 103, 7" diameter x 24" long) are equally at home in the tool room making one of a kind precision threads, or in the production line plunge grinding thousands of threaded or profiled parts.

Wheels may be diamond dressed . . . or Crushtrue® dressed for these advantages:

Greater production: wheel is sharper, grinds cooler. Faster stock removal: no dull flats, no burning, no loading up. Faster redressing: wheel is redressed in seconds. Highly accurate: tolerances on width within .0002", radii within .002", straight sides within .003". RMS finishes as low

as 8 microinch, grooves as narrow as .020".

Standard accessories and special loading, holding, and ejection devices can be made available for specific high production jobs.

May we send you TFG 1159 catalog on models 101 and 103 and Bulletin CR 355 on the remarkable advantages of Crushtrue® grinding?

The

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Dayton 1, Ohio

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October, 1960

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You can do more with

**DELTA**

## NEW 'Long Bed' 10" Metal Lathe offers capacity up to 36"



Delta 10" Metal Lathe with  
Long Bed (36" between  
centers) available in bench  
or cabinet models.

Be sure to register and vote

Now Delta introduces the "big brother" to the 10" Metal Lathe—with a big 36" capacity between centers and an exclusive combination of features that make it the big value in its class.

Here is a low-cost, precision lathe capable of heavy duty work in production, plant maintenance shops and tool rooms. In addition to extra capacity, it provides: variable speed drive with speeds from 50 to 1500 rpm, quick change gear box allowing selection of 54 feed rates or thread pitches, and  $\frac{3}{4}$ " collet capacity—largest available in any comparable lathe.

See your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) or write for FREE catalog: Rockwell Manufacturing Co., Delta Power Tool Division, 610K N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Co. of Canada, Ltd., Box 420, Guelph, Ont.

**DELTA INDUSTRIAL TOOLS**

another fine product by

**ROCKWELL**



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justment knob are conveniently located at the front of the machine.

The grinder is available in Size-Matic, Gage-Matic, or plain models.

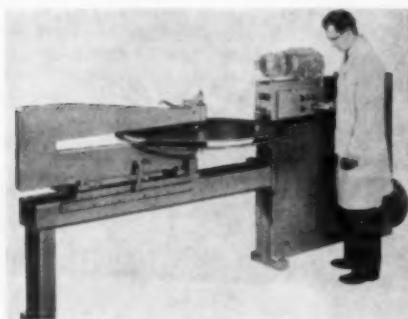
The Heald Machine Co., 15 New Bond St., Worcester 6, Mass.

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### **Redesigned Ring, Circle, Slitting Shears & Flangers**

A modernized line of power operated ring, circle, slitting shears, and flangers improves speed and accuracy in circular cutting and flanging operations. Helpful accessories are available. Designed for medium and heavy sheet metal work, the line consists of six basic types of machines:

Ring and circle shears—three models

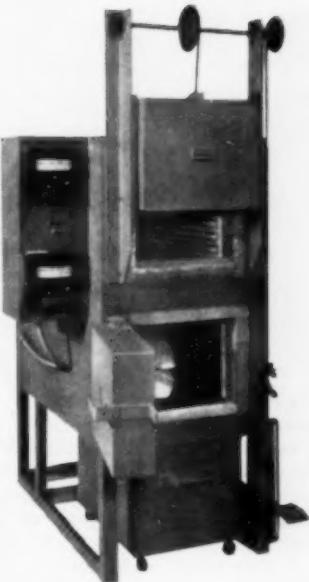


with capacities from 10 ga. to  $\frac{3}{8}$ " mild steel, for cutting circles 6" to 72" dia., starting on the inside or from the edge of square blanks.

Circle shears—six models with capacities of  $\frac{1}{8}$ " through  $\frac{1}{4}$ " mild steel, for cutting circles 10" to 58" dia., starting at the edge of square blanks.

Slitting shears—six models with capacities of  $\frac{1}{8}$ " through  $\frac{1}{4}$ " mild steel, for slitting sheets of any length into widths  $5\frac{1}{8}$ " to 23" wide.

Combination ring and circle shears and flanger—cuts discs 8" to 58" dia. starting at the edge of square blanks (8 ga. mild steel and 12 ga. stainless), turns flanges up to  $1\frac{1}{2}$ " high, forms round heads from  $18\frac{1}{2}$ " to  $73\frac{1}{2}$ " dia.



Two series (8012 and 8008) of "space saver" combination heat treating furnaces are produced by Lucifer Furnaces, Inc. Hardening, drawing or preheating, and quenching operations can be performed with one furnace. Each furnace has separate controls permitting independent operation of each unit. The 8012 series chambers operate at 2300, 2000 and 1250°F., while the 8008 series chambers reach 2300, 2000, and 800°F. The furnaces operate on standard line voltage . . . no transformer necessary. Twenty standard low-cost models are available and each is a complete unit . . . just connect to power supply.

For information about the "space savers", our complete line, or free engineering advice, call on . . .

### **LUCIFER FURNACES, INC.**

Neshaminy 1, Pennsylvania  
Diamond 3-0411

Use postpaid card. Circle No. 334

**LUCIFER "SPACE-SAVER" COMBINATION HEAT TREATING FURNACES**

Combination circle shear and flanger (light work)—cuts discs 5" to 48" dia. from square blanks of 18 ga. mild steel; turns flanges up to 1" high, forms heads 10" to 48" dia. inside flanges. For heavy work—cuts 17" to 80" dia. discs from square blanks of 1/4" mild steel; turns flanges up to 2 1/4" high.

Flanger (for extra heavy work)—produces flanged heads 26" to 105" dia. (inside flanges) from 3/8" mild steel plate. Heads up to 226" diameter can be produced through use of pin pivot. Maximum flange height is 3".

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y.

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### Improved Models of Chipless Machines

Three improved models of Roto-Flo machines for cold-forming splines, serrations, and similar forms have been announced. Improvements allow easier accommodation of shorter production runs on a variety of parts, in addition

to long runs, on a single part. Improvements include hardened and ground ways, synchronizing racks and gear, hydraulic and electrical safety interlocks,



and easily reached exterior hydraulic power unit.

Model 3225 accommodates forming racks to 24" long; Model 3237, to 36" racks; Model 3251, to 55" racks.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

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**Best Economy for Light-Duty Stamping Jobs**

- Wedge-Grip design for deep, clear impressions
- Quick type-change feature

Outfits include from 80 to 154 pieces of type—plus a holder made from non-spalling, non-mushrooming Mecco Safety steel. Write for Bulletin UT.

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238

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**SOFT  
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Soft-Blank Top Jaws are made to American Standards and may be used on any chuck having master jaws made to these specifications. All are in stock and available for immediate delivery.

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MACHINE and TOOL BLUE BOOK

## Cutting Fluid For Machining On Ferrous, Non-Ferrous Alloys

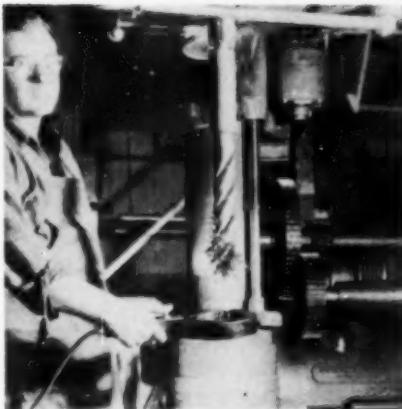
Metalloid WOS is a cutting fluid for machining and grinding that is both water and oil soluble. This fluid may be used on all ferrous and non-ferrous alloys with dilutions depending upon the severity of the operation. Dilutions of 4:1 to 15:1 are considered optimum in either water or oil, but dilutions of 40:1 to 50:1 in water for grinding are not uncommon.

Users report fine finish and increased production and tool life with resulting savings. It is also claimed that the cutting fluid contains no sulphur, and is non-toxic and non-corrosive.

Sample furnished by request on company letterhead.

Metalloid Corp., Huntington, Ind.

Use postpaid card. Circle No. 77



## Demagnetizer Gets Rid of Nuisance Chips From Drills

The Bux Han-D-Mag demagnetizes twist drills, taps, lead screws, and many

other small parts. It will also demagnetize the visible portion of drill press spindles. Unit weighs only 5 lb., is equipped with 8' cord and plug.

Bux Magnetic Products, Inc., 1355 N. 10th St., San Jose 12, Calif.

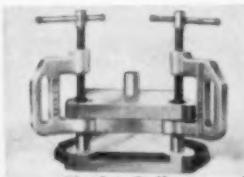
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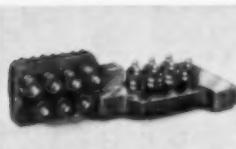


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**CUTTING LIQUID.** New spray-on Micro-Finish is a slow-evaporating cutting liquid for close tolerance machining applications. It is said to combine longer on-the-job liquid stability with rapid lubri-cooling surface action demanded by "difficult" metals. The liquid contains petro-fractions and extreme pressure agents in a chemical medium. Packaged in 16-oz. aerosol cans; available in case lots only. Pacific Petrochemicals, Inc., Box 207, 5161 Triggs St., Los Angeles 22.

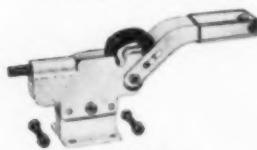


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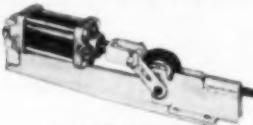
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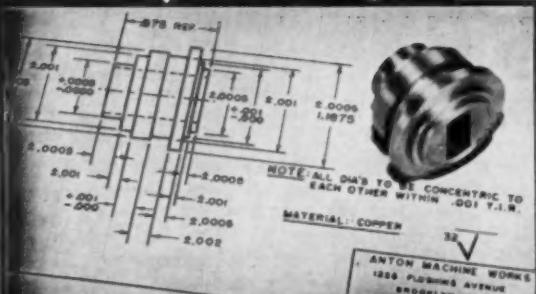
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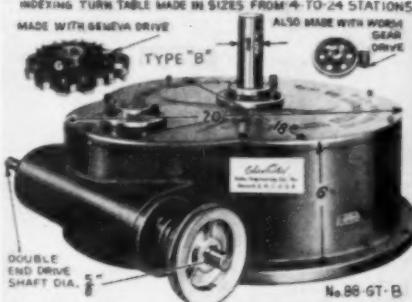
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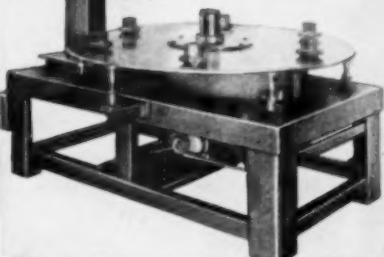
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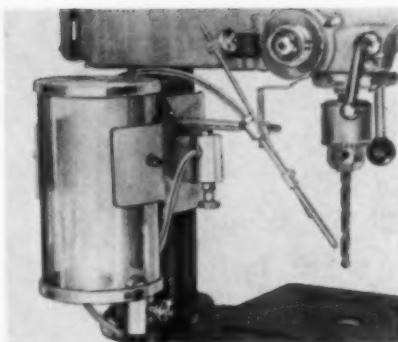
October, 1960

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### Mist Coolant Generator Has Automatic On-Off Operation

A mist coolant generator for drill presses features automatic on-off operation. An air valve, actuated by the drill press spindle, starts the mist when the drill spindle is lowered and stops it when the spindle returns to the up position. Two needle valves control the air and coolant flow for a barely perceptible mist or a heavy spray. An automatic coolant cut-off prevents any siphoning of coolant during idle periods.

The unit may be attached to all drill presses with 2 $\frac{3}{4}$ " columns in a few minutes without drilling any holes. The coolant reservoir has a  $\frac{1}{2}$  gallon capacity. The unit operates from shop air lines.



Mist coolant generator for drill presses.

Priced at \$29.50.  
Stute Mfg. Co., Varna, Ill.

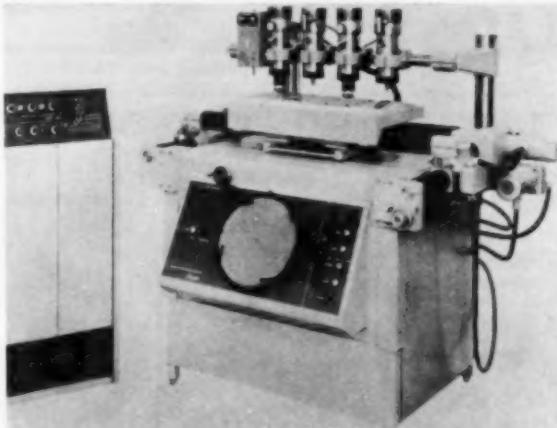
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### Automatic High-Speed Circuit Board Drilling Machine

Introduced to the electronics and electrical industries is a new automatic high-speed circuit board drilling machine that is designed to increase hole-positioning accuracy to one-thousandth of an inch, practically eliminate human error and save a substantial number of man-hours in programming.

Coupled with Micro-Path's magnetic tape control, the new MPI 440 automatic circuit board drilling machine is capable of drilling 40 holes per minute with each drill head; 640 holes per minute with four stacks of four boards each; with an average positioning time of less than one second.

One of the outstanding features reported for the machine is its optical programmer. Essentially a comparator



Optical programmer is a comparator with 14" viewing screen.

equipped with a large 14" viewing screen, the programmer is described as simple to operate, making it possible for a speed-up in programming as well as significantly reducing the number of hole-positioning errors.

Micro-Path Inc., 4949 W. 104th St., Inglewood 2, Calif.

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### Air Die Grinder Delivers 0 to 25,000 Controllable RPM'S

Model 1600 air die grinder has a metering trigger that delivers 0 to 25,000 controllable rpm's—lets operator "throttle down" for feather edging. The grinder is recommended for polishing, wire brushing, and metal removal on dies, stampings, etc. Grinder takes standard rotary files, standard or carbide wheels, wire brushes, mounted points, sanding drums. Wheel capacity is 1 1/4" vitrified and 1 1/2" organic. Air consumption is 6 c.f.m. at 90 p.s.i. Weight is 15 oz., length 6". Price complete, \$89.50.

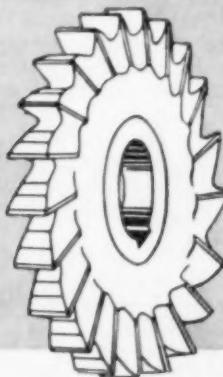
Superior Pneumatic & Mfg., Inc., 13800 Enterprise Ave., Cleveland 35, Ohio.



For rough grinding or feather edging.

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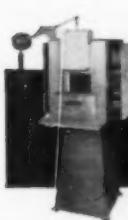
## Better Tools From **SENTRY** Hardening



THE TRUE TEST of your machine tools is their performance on the job — how they benefit your production. This is where Sentry Furnaces with the Diamond Block method of atmosphere control demonstrate their value. Your high speed steel tools hardened in the truly neutral Sentry Diamond Block atmosphere achieve maximum hardness without scale or decarburization, maintain their sharp cutting edges longer, step up production.

Write for literature and send sample of your tools for free demonstration hardening.

505-9



# Sentry

## ELECTRIC FURNACES

Request Catalog S-5. Write THE SENTRY CO., FOXBORO, MASS.

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## Grinder Uses Box-Type Column And 125 Spindle Horsepower

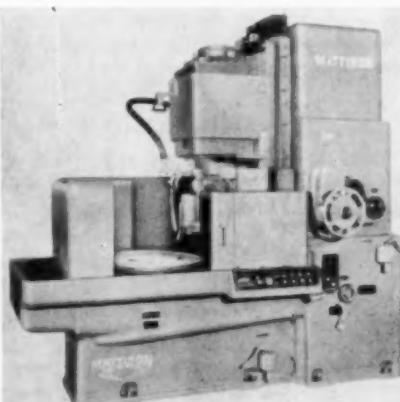
A one-piece, box-type column backs up spindle horsepowers as high as 125 on the new No. 24 vertical-spindle rotary surface grinder. With a capacity up to 48" dia., the grinder has the advantage of Mattison's Quick-Tilt grinding head. The tilted wheel rough grinds to within "thousandths" of final size. With a flip of the switch, the wheel is returned to dead flat position for a finish grind.

A primary reason for increasing horsepower and rigidity is to take advantage of improved grinding wheels—coarse, hard wheels capable of heavier cuts. They are also self-dressing, a saving in time.

Downfeed of the grinding wheel is continuous from .005" to .165" per minute. When work reaches desired size, the wheel disengages instantly by predetermined stop.

A choice of automatic sizing systems

is offered to control quality and cycle time. Both continuously measure piece-parts during the cut, with positive controls sensing actual size of work as it is ground. An air-gaging system provides visual and electrical indication when work approaches size. The electrical-mechanical system actuates the



Quick-Tilt grinding head takes advantage of improved grinding wheels.

automatic cycle and returns the machine to reload condition when preset size is reached. By either method, operators can set maximum feed, then grind to size in one uninterrupted cut without miking.

To match the increased rigidity and horsepower are cylinder wheel capacities to 22" x 4" x 18" and segmental wheel sizes to 22" x 6" x 19".

Machine uses 30" through 42" magnetic chucks, with alternate 48" swing offered.

Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.  
Use postpaid card. Circle No. 86

## Instrument Indicates Positions of Any Machining Tool Table

The Vernac, an easy-to-use direct-reading optical measuring instrument with no moving parts, indicates the longitudinal, lateral, or vertical position of any machining tool table. It can



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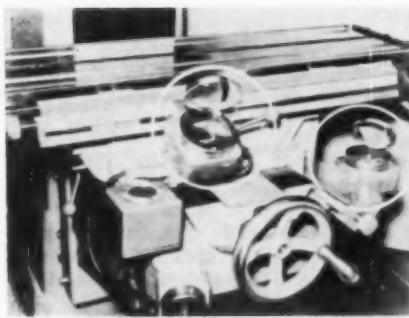
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be read to an accuracy of 0.0001" without interpolation by means of a scale affixed to a machine tool table.

Designed for incorporation both on new and existing equipment, the instrument is said to eliminate inaccuracies due to wear and stretch of table screws and damaged end rods and gage blocks.

Simpson Optical Manufacturing Co.,  
3200 W. Carroll Ave., Chicago 24, Ill.

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ONE DRILL PRESS  
TAKES THE PLACE  
OF 4 OR 5 WHEN  
YOU USE...

CHICAGO  
QUADRILL  
4 & 5 SPINDLE  
TURRET  
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HEADS

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BORE AND COUNTERSINK ON A  
COMMON TOOL AXIS.

Convert your standard drill presses into precision turret drilling machines—save on floor space, capital equipment costs (up to 350%) . . . up to 70% IN DIRECT LABOR COSTS over in-line, single gang drill setups. Easy to install. Ideal for both long and short runs . . . fast setups . . . simple tooling.

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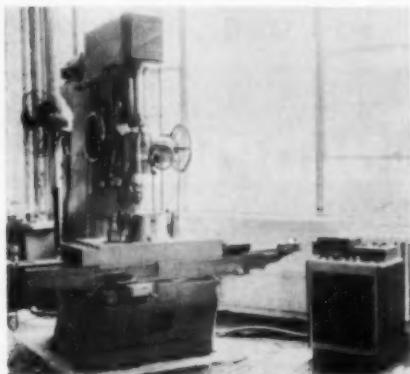
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*Company*

1846 BUSSE HIGHWAY DES PLAINES, ILLINOIS

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## High Accuracy at Low Cost Is Claimed For Numerical Controls

Production accuracy of up to  $\pm .0002$  on a 40" work table, flexibility achieved through modular design, and economy are advantages reported for a newly-developed numerical control system. It is claimed economy of operation is provided by modular design. Rapid change of the modular units is easily accomplished by a plant technician. Modular components include a tape reader, distributor, digital analog converter, notch phase discriminator, mechanical module, position indicator control, and servo-micrometer. The high degree of accuracy claimed is



Numerical control with Atlantic jig borer.

accomplished by separation of the actuating system from the measuring system.

The Singer numerical positioning control system comprises two basic functional sections—data processing and response mechanism. The former establishes an analogue signal proportional to machine motion from a fixed reference point. This is established by tape command, decade switch input, or punched card. The response mechanism section establishes machine motion proportional to the analogue signal output of the data processing system. Final positioning is obtained

by means of a special electro-mechanical micrometer system.

The unit may be used for automatic control of drill presses, turret punch presses, lathes, milling machines, jig borers, and other types of fabricating equipment. It also may be adapted to control operations of spot welding machines, component assembly machines, model positioners, type setting machines, and many other opto and electro-mechanical devices.

Diehl Mfg. Co., subsidiary of The Singer Mfg. Co., Somerville, N.J.

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Honer is offered with 25", 35", 45", or 60" spindle travel.

## Vertical Honer For Large Bores to 10" Dia.

The Model 3010 honer is available with 25", 35", 45", or 60" spindle travel. The machine will hone bores up to 10" in diameter at maximum stroke, and it will hone larger diameter bores in shorter lengths.

Since no auxiliary electric panels are used, floor space is reduced and external conduit is kept to a minimum. All electric controls are built into the two side panels of the machine.

To change spindle speeds, the operator simply turns the two knobs on the right side of the head. One knob selects neutral, low, or high speed ranges, and the other knob selects the specific speed in either the low or high speed range. Eight speeds are provided by a 10 hp motor with a Vee belt drive.

A new electric hone expansion mechanism and Barnesdril Plugmatic bore sizing mechanism are said to maintain size consistency within tenths

of thousandths from bore to bore, at high production rates.

A separate 10 hp motor powers the hydraulic reciprocation.

This machine can short stroke at any point in the bore, and it is available with a dwell mechanism. A wide variety of fixtures and tables can be adapted to meet individual production requirements.

Barnes Drill Co., 852 Chestnut St., Rockford, Ill.

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## DO YOU WANT FAST, ACCURATE SCRATCH-FREE BENDS?

Dan Smith, Shop Supt. at Columbus Stamping and Mfg. Co., Columbus, Ohio, says: "Bends fast . . . never scratches prepainted tubing . . . no maintenance in three years."

**FAST, VERSATILE MODEL 1400 BENDS TUBING, BARS, PIPE, ANGLES, CHANNELS, ROLLED SHAPES OR EXTRUDED PARTS**

- **SAVES TIME, CUTS COSTS** — on production, experimental, maintenance or small lot bending jobs.
- **ELIMINATES WORKPIECE INTERFERENCE** — on jobs with multiple planes, odd shapes. Pivoting top assembly and double tool holder ways on arms permits two-minute change from right-hand to left-hand bending.
- **ACCURATE HYDRAULIC POWER** — with convenient controls bends consistently to  $\pm 1/2^\circ$  tolerance.
- **PRODUCTION CAPACITY** — smooth, low-cost bends at speeds of 300 to 400 an hour; material up to 1 1/4" O.D. tubing.

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PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

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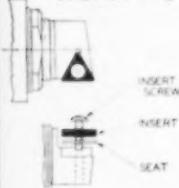
#### SCREW-ON TYPE



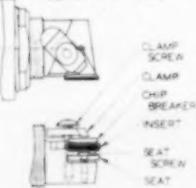
#### CLAMP-ON TYPE



#### SCREW-ON TYPE



#### CLAMP-ON TYPE



### Adjustable Insert Units In 21 Sizes

Beaver's Calibore insert unit uses triangular carbide inserts with inscribed circles of  $5/32$ ,  $1/4$ , and  $3/8$ ". They are available in two styles—screw-on and clamp-on-types. The screw-on-type units have a minimum bore diameter of 1.50; the clamp-on-type units, 4.01. There are 21 sizes available in the zero, positive, or negative rake angles.

Carbide seats are used in all units except the sizes using the  $5/32$  I.C. insert. Clamp-on type units are equipped with an adjustable carbide chip breaker.

The carbide inserts can be indexed three times in the units with zero and positive rake angles. Six indexes of the carbide insert are possible by inverting the insert in the units with a negative rake angle.

The units are adjustable in increments of .0005 on bore diameter per graduation on mounting dial.

Beaver Tool and Engineering Corp., 500 W. County Rd., Gaylord, Mich.

Use postpaid card. Circle No. 90

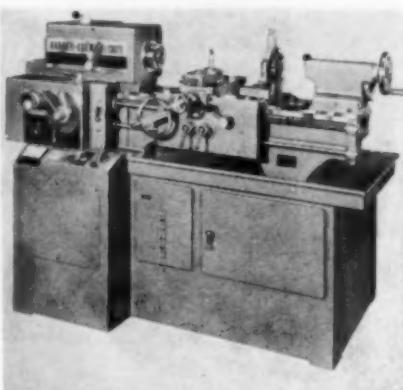
### Super-Precision Lathe Combines Versatility & Wide Work Range

In its 10" class, the model 1307T offers wide work ranges and numer-

ous quality specifications. Outstanding features reported include: specially selected Class ABEC-7 super-precision spindle bearings; ground-from-the-solid actuating screws throughout; antifriction bearings on all rotating shafts; direct-reading microdials, etc.

Infinitely variable speeds to 3000 rpm in belt drive can be changed under load, without taking time to stop, start, or shift gears. A 5 hp motor powers a silicon-rectifier drive.

Extra-large capacities include the 13" swing over ways; 24" center dis-



Extra-large capacities—13" swing over ways; 24" center distance; 1 $\frac{1}{2}$ " spindle bore.

tance, 2 $\frac{3}{4}$ " compound rest travel; 1 $\frac{1}{2}$ " spindle bore, and a D1-4 cam lock spindle nose.

Lathe has 66 quick-change feed and thread-cutting changes in each of two ranges. Straight gear drive provides feeds from .002" to .120" per work revolution; belt-driven feeds, from .001" to .060". Machine is said to cut practically any number of threads with one, two, three, four, six, and nine starts.

Barber-Colman Co., 593 Loomis St., Rockford, Ill.

Use postpaid card. Circle No. 91

### Device For Compound Angle Set-Up

The Triangulator offers a solution to the compound angle set-up problem. This device consists of two 360° protractors set at 90° to each other with a sturdymount plate at the top and a solid secure base. By use of release levers to disengage the worm gears, any compound angle on a spherical are can be set, adjusted, and locked to within one minute of arc. Device is applicable for inspection, layout work, grinding, and drilling. Two sizes are offered, with up to 300 lb. load cap.

Scientific Engineering Co., 11126 Weddington St., N. Hollywood, Calif.



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# WOW!!!

## UNBREAKABLE TAPS

UNBREAKA TAPS • UNBREAKA TAPS  
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### SHEARCUTTER TOOLS COST LESS

These ultra-scientific cutting tools are used by practically every large manufacturing company in the U.S.A. Constant repeat orders prove their merit and value.

Patent Warning: All Shearcutter Tools protected by U.S. and Foreign Patents, received, pending or applied for.

### SHEARCUTTER UNBREAKA TAPS

- Are practically unbreakable.
- End tapping trouble.
- Produce better tapped holes.
- Feed the chips out in front of the tap.
- Have an amazing long life.
- May be resharpened many times.
- Require only half the power generally required for tapping.
- Lower tapping costs.

## SHEARCUT TOOL CO.

MANUFACTURERS OF THE WORLD'S MOST SCIENTIFIC CUTTING TOOLS

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Reseda, California

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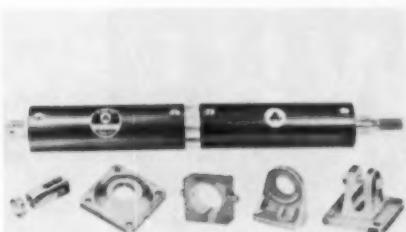
October, 1960

249

## Advantages of Hydraulic Control to Air-Operated Cylinder

Allenair Corp. announces a new line of tandem cylinders, to be known as Models "BT". The cylinders are available in bore sizes of 1½", 2", 2½", 3", and 4", in lengths up to 80". A choice of mounts is offered.

The rods are stainless steel, and the steel or brass tubes are treated for corrosion. The units are intended to provide the advantages of hydraulic control to an air-operated cylinder. The



Cylinders are offered in bore sizes 1½", 2", 2½", 3", and 4", in lengths up to 80".

hydraulic fluid can be used either in the front cylinder or in the center section of the unit without a make-up chamber. Full speed control is obtained by simply piping flow control valves in series with the two ports used for the hydraulic section.

Another advantage of the new units is that by using pressure in both sections, the usable force available is reported as exactly twice as great as the force obtainable from a standard cylinder of same bore size. This permits their use in spaces too small for larger bore standard cylinders.

Allenair Corp., 255 E. 2nd St., Mineola, New York.

Use postpaid card. Circle No. 93

## Measuring Instrument For Analyzing Threads

The Helical Path Analyzer analyzes

both linear and "drunken" deviation from the true helical path of thread plug gages or similar precision threaded parts, such as those used in aircraft instruments and guided missile control



Instrument analyzes both linear and "drunken" deviation from the true helical path of thread plug gages or similar precision threaded parts.

and timing devices. It can check deviations to an accuracy of .00003" over three revolutions on external precision threads. The results are recorded graphically on a chart recorder. Indexing is continuous and automatic.

It is reported the analyzer measures deviations in threads that up to now could not be accurately detected, making it suitable not only for use in gage laboratories, but also for making production analyses, to correct thread gage or thread grinders to produce highly reliable thread plug gages and fasteners.

The instrument has a work capacity of 8" between precision centers and a 6" maximum diameter. It can check thread lengths up to 5", and all pitches and thread forms.

Fratt & Whitney, W. Hartford 1.

Use postpaid card. Circle No. 94



Pi Tape is made of spring  
steel .010 thick.

Use postpaid card. Circle No. 95

#### Accurate Diameter Measuring By Tape

Pi Tape is used for checking diameters of thin-walled parts, large or small, and eliminates taking four to eight micrometer or caliper readings and then finding the average of these by adding and dividing. The circumference of the part is checked and the true diameter is read directly from the tape to an accuracy of .001 by means of special graduations and vernier. Only one reading is necessary for both round and out-of-round diameters. Special go and no go tapes can be made to customer order.

Pi Tape, 7952 N. Ave., Box 397, Lemon Grove, California.

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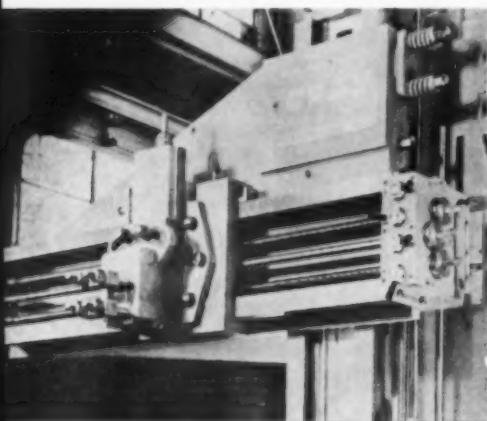


**ADAMAS** CARBIDE  
CORPORATION  
KENILWORTH, NEW JERSEY

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## Flying Scot Features Hydraulic Infinite Feed Range

The recently introduced Flying Scot small openside planer features a unique



Dials controlling saddles, slides, and rail are calibrated in thousandths of an inch. The dials can be set manually by means of safety crank when machine is not running. The arrow-faced dials are used for adjustments in positioning when machine is in operation.

control station which facilitates the rapid positioning of saddles, slides, or rail. The control station is hydraulic and permits an infinite saddle feed from 0 to  $\frac{1}{2}$ ".

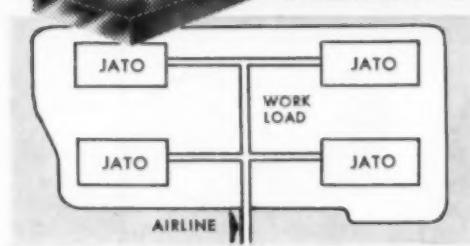
The planer is designed for fast carbide planing. It cuts both ways. Nine combinations of table widths and heights are available. Basic sizes are 30", 36", 42".

G. A. Gray Co., Cincinnati 7, Ohio.  
Use postpaid card. Circle No. 97

## Fully Automatic Microstoning Unit Gives Fine Finish

The Supfina No. 86 centerless plunge cut Microstoning machine is designed to operate with a fully automatic work cycle. The machine finishes the outside diameter of all types of small parts which require an unusually fine micro-inch finish, precise form accuracy, and sound surface structure. The machine microstones parts by turning between two rotating rolls, where they are kept in contact with a rapidly oscillating abrasive stone. This microstoning removes the amorphous surface layer left

## HEAVY\* PRODUCTION LOADS



\*UP TO  
100 TONS

Work loads of cumbersome weight, odd sizes and shapes, can be moved fast and accurately over machine tables. One square inch of Jato area supports 25 pounds of load. Four 12" x 20" plates in series would permit an operator to position a 200,000 lb. casting with one hand using 80 lb. pressure on the air line.

WRITE TO: UNION MANUFACTURING CO.

290 Church Street, New Britain, Conn.



Makers of UNION CHUCKS AND ULTRA PRECISION DIE SETS

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## Standard ZAGAR Gearless Drill Heads



DRILL ANY NUMBER OF  
HOLES . . . IN ANY PAT-  
TERN . . . IN ANY MA-  
TERIAL . . . ON ALL  
CENTERS!

Drill a maximum number of holes in one pass—as close as twice drill diameter. Zagar heads are built as a complete unit or may be adapted to any standard drill press. Send us your part drawing for quotation.

Get more information in Bulletin B-10.

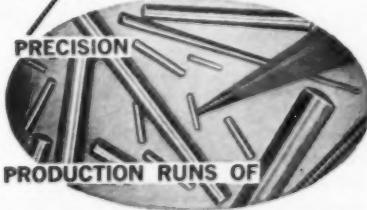
**ZAGAR, INCORPORATED**  
23900 Lakeland Blvd., Cleveland 23, Ohio

*Zagar*

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WRITE *Peaslee* FOR



## TAPER PINS

DIAS. 9/0 to #4

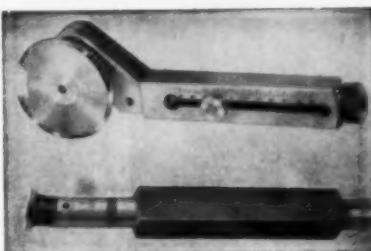
As specialists in stainless-steel, instrument-type pins, we offer quantity runs of standard size Taper Pins. Tolerances are held to .001 on dia. Sizes run from #4 down to 9/0. Send your blueprints for prompt quotation.

**THE PEASLEE METAL PRODUCTS INC.**  
470 Tolland St. • East Hartford 8, Conn.

Use postpaid card. Circle No. 346

October, 1960

## THREAD CUTTING TOOL



Provided with a scale  
for angular setting.

Circular Cutter, in high speed or carbide, has a negative profile and machines both thread flanks simultaneously. Thread cutting discs for all threads are available for both external and internal tool holders.

## ACME TOOL CORP.

71 West Broadway, New York 7, N. Y.

Use postpaid card. Circle No. 347

## Allman Universal Hand Tapper 5 TIMES FASTER

A great time, labor and material saver. Fixture taps five holes to every one using the free hand method. Eliminate costly tap breakage.

### CHECK THESE FEATURES:

- Articulate arm swings clear of large table for placement of work.
- Limitless number of sizes of tapped holes without moving work piece.
- Vise holds work as small as  $\frac{3}{8}$ " square.
- Floating tap locates itself in hole.
- Individual spindle holds taps, thus change requires only seconds.

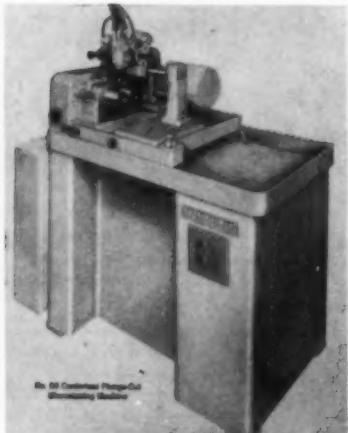


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**TOOLS,  
INC.**

1735 No. 25th Ave. • Melrose Park, Ill.

Use postpaid card. Circle No. 349



Workpieces up to 2" long with diameters from  $\frac{1}{8}$ " to  $1\frac{1}{8}$ " can be finished.

by the cutting pressures and temperatures of previous machining operations, and corrects errors such as chatter marks and feed-spirals, and out-of-roundness. Depending on part material,

hardness and initial roughness, it is reported that surface finishes down to one microinch can be generated with simultaneous out-of-roundness correction of 75% or better.

The new machine uses the high oscillation and variably controlled amplitude principle used on Supfina machine tools in Europe. The micro-stoning head operates from a frequency of 2,000 to 3,200 cycles a minute, and its amplitude is infinitely adjustable from  $.080"$  to  $.200"$ . There are a number of set-up variations possible.

The machine is designed specifically for fast cycling and for hand or semi-automatic work loading. Workpieces up to 2" long and varying in diameter from  $\frac{1}{8}$ " to  $1\frac{1}{8}$ " can be finished.

The finishing operation is automatic, and operators are only required to load and unload parts.

The Taft-Peirce Manufacturing Co., Mechanic Ave., Woonsocket, R.I.

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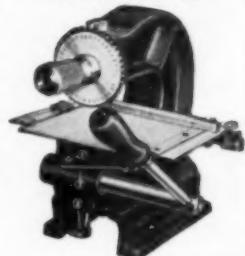
## NUMBERALL

SAVES THE COST OF STAMPING NUMBERS

Designed for the purpose of impressing Letters and Numbers in all kinds of Name Plates and Flat Metal Parts. The Dials  $3\frac{3}{4}$ " Diameter are made of Special High Grade Tool Steel, scientifically hardened and tempered. The Characters are carefully engraved and make clear cut impressions of uniform depth. Standard Dials are engraved with 40 characters. Character Heights as follows:  $1/16$ ,  $3/32$ ,  $1/8$ ,  $5/32$ ,  $3/16$ ". Different size Dials are interchangeable. Carriage Table advances space with each impression of the Dial, like a typewriter, doing rapid work, even spacing and perfect alignment. Plates up to 5" wide and 6" long can be stamped, but can furnish a longer Table and Rack if required. Depth of impressions is adjustable by a screw on bottom of machine. A direct sight gauge is provided to facilitate stamping in the proper place.

## Numbering and Lettering Press Mono Wheel Automatic Spacer

### MODEL NO. 40B



Specialists in making devices for stamping details into Name-plates, such as Automatic and Non-Automatic Numbering Machines, Type and Type Holders, and Chases, etc.; also Presses. We can also make steel type with round face characters.

Bulletin BB-40B  
on request

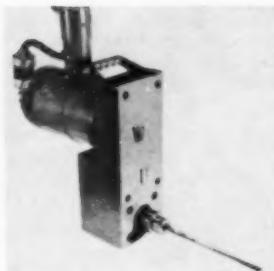
**NUMBERALL STAMP & TOOL CO.**  
HUGUENOT PARK - STATEN ISLAND 12, N. Y.

Use postpaid card. Circle No. 350

## High Speed Gun Drilling On Lathes

New Model 5-100 series gun driller fits, without an adapter, No. 5 or larger ram-type turret lathes; with an adapter, saddle-type lathes. Gun drill sizes from 3/16" to 5/8" fit the 3/4" spindle bore. A choice of four spindle speeds include 1748, 2450, 3345, and 4600 rpm; with a high speed model, to 6000 rpm. Unit mounts on the turret face, for rigidity at all times. Distance from the spindle end to turret face is 7 1/2". The gun driller fits Warner & Swasey lathes, No. 5 or larger, etc.

Ward-Riddle Co., 241 Myrtle St., Ravenna, Ohio.



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## Industry's NEWEST Production TOOL

# MOLYKOTE® G

LUBRICANT

- ALMOST 100% SAFETY AGAINST GALLING AND SEIZING WITH ALL BEARING METAL COMBINATIONS
- ELIMINATES STICK-SLIP, METAL PICK-UP AND DISTORTION IN PRESS FITTING
- REDUCES WEAR-IN TIME AND DAMAGE IN NEW OR REBUILT MACHINERY
- THE HIGHER THE LOADS, THE GREATER THE MARGIN OF SUPERIORITY OF MOLYKOTE G

Write for your free sample of MOLYKOTE G LUBRICANT today. We will also send you a copy of our new Bulletin 125 which gives complete details. THE ALPHA MOLYKOTE CORPORATION, 65 Harvard Avenue, Stamford, Conn. Phone Frieside 8-3724. Plants in Stamford, Conn., Munich, Germany and Strasbourg, France.

THE ALPHA-MOLYKOTE CORP.	MTTB-10
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### Contour Projector With 14" Screen Is Rugged and Accurate

Versatile, rugged, and accurate to tenths, the "heart" of the Ex-Cell-O Model 14-5 is the optical system designed and manufactured by Eastman Kodak Co. Coated "Ektar" lenses in the optics and the "Fresnel" lens behind the screen are said to guarantee bright, glare-free images under normal room illumination.

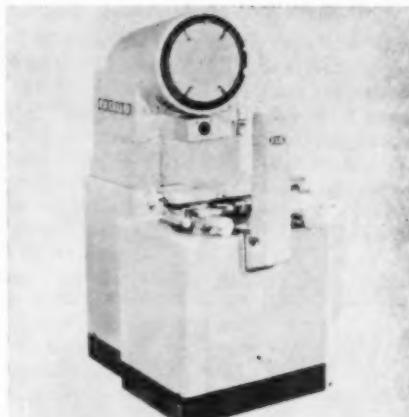
The contour projectors also afford the operator the largest staging area, with plenty of room to measure large objects.

The contour projector line consists of six models ranging in screen size from 8" to 30".

A new high-pressure mercury arc lamp is now available for the 14" and 30" screen sizes. Complete switch-over from standard illumination to the high intensity of the Mercury Arc can be achieved quickly.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Use postpaid card. Circle No. 100



Model 14-5 with 14" screen.

### Pilot Punch Easily Removes Spring Pins

The manufacturer claims these new pilot punches will speed up pin removal and eliminate damage to pin or wall



of holes. Also, the pin may be driven completely through hole without sticking punch. Twelve sizes match all standard pin diameters and maximum lengths.

Mayhew Steel Products, Inc., Shelburne Falls, Mass.

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**Frank NEW DUPLEX HARDNESS TESTER**

for all NORMAL AND SUPERFICIAL Tests in ONE low-priced machine.

6 Major loads of 150, 100, 60, 45, 30 and 15 kg available by push-button control, plus selective 10 and 3 kg minor loads.

Request Circular #506

**OPTO-METRIC TOOLS, INC.**

137 BB VARICK STREET, NEW YORK 13.

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**MEL-O-FLO®**

**COOLANT AERATOR**

- STOPS SPLASH
- CUTS MAINTENANCE COSTS

Install one and be convinced!

**Melard Products, Inc.** 2926 White Plains Rd.  
N.Y. 67. N.Y.

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MACHINE and TOOL BLUE BOOK

## Super Fine Precision Measurement

Micro-Line introduces a new photographic imaging technique in the field of super fine precision measurement. This system is independent of any screw, slide, or propelling mechanism. It is easily attached to milling machines, jig borers, grinders, etc.

The master 24" Micro Scale subdivided throughout its entire length into intervals of 1000 lines per inch has been certified to an over-all accuracy of .0001" by the U.S. Bureau of Standards. The vernier situated in the eyepiece of the microscope gives direct reading to 1/10,000th of an inch. There is no guessing, no calculations, and settings can be made speedily and accurately.

An outstanding feature reported is that repeatability of settings to .000040" is possible and visible to the naked eye.

Special linear scales can be designed to meet customer requirements. Although ultimate lengths are presently



This process is said to make possible photo reductions of a million or more diameters without distortion.

unknown, 4' to 5' lengths are definitely possible.

Micro-Line Inc., 7 Osmer St., Jamestown, N.Y.

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## PERMANENT MAGNETIC CHUCKS

AT SENSATIONAL PRICE

Eliminates clumsy fixtures and jigs • Retains holding power indefinitely • Non-Magnetic steel base gives greater stability • Insensitive to shock and the effects of cooling fluids • No need of electricity so the danger of short circuits is eliminated.



- Precision made
- Fully guaranteed
- Imported

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(Inches)

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PRICE

CIRCULAR TYPE

OUR  
PRICE

Size (Inches)	Height (Inches)	TYPE	OUR PRICE	OUR PRICE
4 x 6	2 1/2		\$ 57.50	
4 x 8	2 1/2		62.10	6
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6 x 14	2 1/2		103.50	
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For tremendous savings, write for free circular

## MANHATTAN SUPPLY COMPANY

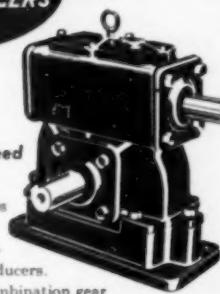
The Cutting Tool Discount House  
151-A Grand St., New York 13 • CAnal 6-4992

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October, 1960

FOR ECONOMICAL  
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## Abart SPEED REDUCERS



- compact design
- rugged construction
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Choose from Abart's complete line of space-saving, precision-built speed reducers.

Worm, spur and combination gear models — single or double reduction — fractional to over 400 hp. ratings, ratios to 10,000 to 1. Supplied in 75 different types and sizes with any desired shaft arrangement.



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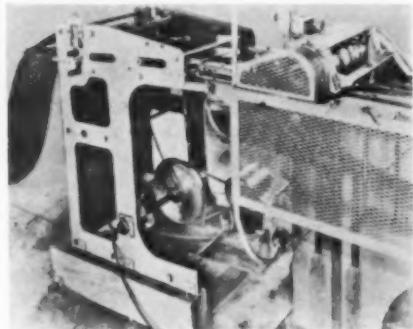
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257

## Portable Flying Cut-Off Shear For Coiled Strip

Model C-571 portable shear, for cutting off metal strip while it is in motion during automatic forming operations, is said to handle 15" wide, 20 ga. steel or 16 ga. aluminum strip at up to 7,000' per hour.

A strip passes through the shear into a forming machine. When a predetermined length of strip passes through,



Cap.: 15" wide, 20 ga. steel, 7000' per hour.

a limit switch actuates the shear and the cut is made. The shear is equipped with feed rollers operating at slower speed than the forming machine; it feeds stock to the forming machine, allowing time for removal of product or providing spacing for subsequent operation.

Power is provided by a 1 hp, 220-440 v motor.

Cost is \$3050 f.o.b. Minneapolis.

Crest Engineering Co., 529 S. 7th St., Minneapolis 15, Minn.

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## Small Vibratory Parts Feeder For Miniature Type Parts

A new compact low cost vibratory parts feeder unit is especially designed for the smaller or miniature type parts of less than  $\frac{1}{2}$ " long. Its method of fabrication is said to allow exceptional pricing for both single unit use or as an O.E.M. component to production machines.



New small size.

Unit is complete with built-in control and interchangeable bowl of 7" dia. Over-all height is  $6\frac{1}{2}$ "; mounting base, only 8" square.

Burklyn Co., 3429 Glendale Blvd., Los Angeles 39, Calif.

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## Name Plates Offered in Various Types

A complete line of name plates for manufactured products of all kinds has been announced by Ward's Name Plates. Heavy gage metals (attached with



rivets or screws) to self-adhesive foils and decals are available in any size, shape, metal, or colors. They are made to customer specifications, in short or volume production—chemically etched, lithographed, silk screened or anodized—with a scratch and weather resistant finish.

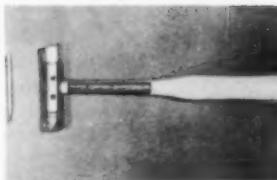
Ward's Name Plates, 8502 Lyndon Ave., Detroit 38, Mich.

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## Double Ended Industrial Hammer

Double ended industrial hammers have no threads like other changeable headed hammers. Heads are held tighter with use. A tapered shaft in a tapered hole is the method of holding the heads. A knock-out pin is used for removing the heads. Because of this holding method, both brass and various forms of plastic heads can be used. Hammer has a compact steel body. In size 14 oz. 1" dia., with plastic heads, \$3.98; 20 oz. 1 $\frac{1}{4}$ " dia., with plastic heads, \$4.78. Nylon and brass heads are slightly higher. Additional heads are available.

Dumas Co., 1 Jackson St., Worcester 8, Mass.



Because of holding method brass and various forms of plastic heads can be used.

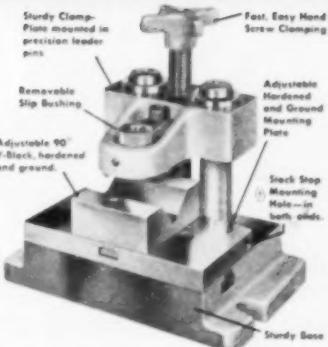
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## REPCO Time-Saving Tools

### ADJUSTABLE V-BLOCK DRILL JIG

#### Saves Set-Up Time—Increases Output

Here is a versatile and accurate V-Block that makes center and off-center drilling, tapping, and reaming easy and precise. Four-way V-block adjustment simplifies handling a wide range of work. Fast, easy positioning and clamping speed production. A centering locator plug and T-slots in the mounting surface plates assure fast, easy, on-center adjustment. Drill capacity #80 to 1 $\frac{1}{2}$ " diameter. Handles stock from  $\frac{1}{4}$ " to 2" diameter.



#### TRUE-CENTER ADJUSTABLE TOOL HOLDER



The REPCO Adjustable Holder is a precision-built, one-piece construction which provides fast adjustment of the main body to compensate for as much as 1 $\frac{1}{2}$ " machine misalignment. Cuts down on tool wear, breakage, and scrap.

#### TWO-PIECE VISE SET



Save time with this versatile 2-Piece Machine Vise Set. Unique general-purpose vise, angle-block, or separate clamping device. Clamping force up to 1000 lbs. on machine base. Light, accurate, rigid. Two sizes 6" and 8".



#### CHUCK JAW TRUING-RING SET

This Ring Set saves time, cuts cost of boring jaws. With correct diameter rings at hand, you gain hours of productive time. The rings are available from 1" to 4" by  $\frac{1}{16}$ " increments. Handy peg-type lock keeps rings in place.

#### COMBINATION LIVE-CENTER SET

Heavy-duty live center plus six interchangeable adapters, ranging from a point to 6 $\frac{1}{4}$ " dia. ball. Saves costly set-up time and eliminates the time necessary to make large-diameter centers. Straight and various taper phonons available.



Write for complete information—Exclusive agent territories open.



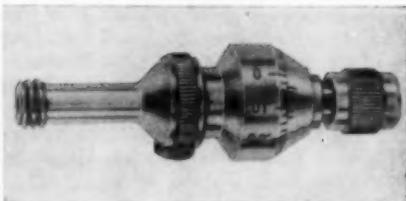
ROCKFORD ENGINEERED PRODUCTS CO.

2332-23rd Avenue • Rockford, Illinois

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### New Type of Thread Gauge

The SPV universal thread gauge, type ATG, is an instrument by which the pitch diameter of internal threads can be measured with high accuracy (.0002"). The extent of the error is directly readable. The ATG can also be used as a maximum gauge adjustable to various tolerances and as a maximum/minimum gauge for stud bolt fits. Wear is compensated for by zero setting with a master ring.



Homestrand Machine Tool Corp.,  
Greenwich, Conn.

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### 45,000 RPM - HIGH TORQUE



### ELECTRIC JIG GRINDERS

Converts an accurate vertical milling machine for electric jig grinding and carbide jig milling.

Precise Jig Grinders are custom built vertical milling machine conversion units — for grinding or rapid carbide micromilling of holes to tolerances of .000,1" and closer — at speeds and feeds never before possible with low torque, wasteful, air turbines! Surface finishes well within 10 micro inches. Models with manual and automatic feed as well as special models to convert jig grinders with air spindles to electric quills. Infinitely variable speed — 15,000 rpm to 45,000 rpm. 1½ hp output; max. hole size 3¾".



Grinder-Millers, Power Quills, Jig Grinders,  
Milling Machines, Automatic Drill Units  
Cutting Tools, Vapor-Lub Cooling  
Sklero Hardness Tester

Quality and Precision Since 1882

*Precise*

### PRECISE PRODUCTS CORPORATION

3731 Blue River Road, Racine, Wisconsin, U.S.A.

Branch Plant: Precise, G.m.b.H., Duesseldorf, Germany

F105

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### Pneumatic Grinder With 50,000 RPM Speed

This 6½" long Model 60 Cyclone grinder is said to give the maximum in results when used with carbide burs, rotary files, and mounted grinding wheels. Desirable speed is 50,000 rpm. Important parts include the flexible air control lever for starting and stopping; adjusting screw which controls valve that regulates speed of spindle for varying air pressures, and grease-sealed type bearings which require no manual or automatic lubrication. Spindle accommodates mandrels ¼" dia. Collet ¼" O.D., ⅛" or 3/16" I.D. is available for use in spindle.

M-B Products, Inc., 46 Victor Ave., Detroit 3.



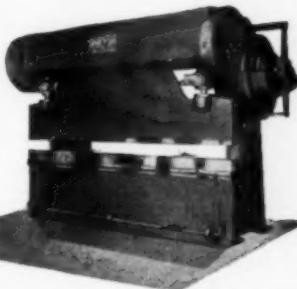
6½" long grinder.

Use postpaid card. Circle No. 100

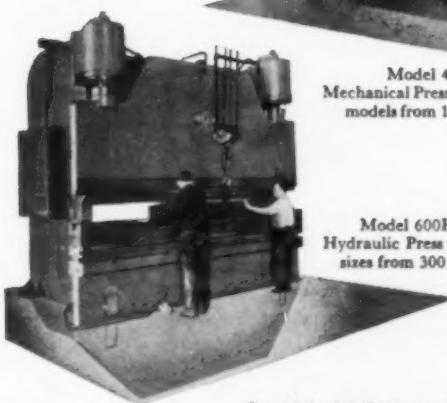
## CHICAGO® PRESS BRAKES

UNEXCELLED ACCURACY

for sheet metal  
and plate work



Model 410D, 90-Ton CHICAGO  
Mechanical Press Brake. Other standard  
models from 11 to 450 ton capacities.



Model 600H10, 600-Ton CHICAGO  
Hydraulic Press Brake. Other standard  
sizes from 300 to 2000 ton capacities.

8480

Complete details or recommendations  
on any press brake work upon request

Press Brakes  
Press Brake Dies  
Straight-Side-Type Presses  
Hand and Power Bending Brakes  
Special Forming Machines



**DREIS & KRUMP**  
MANUFACTURING CO.  
7440 S. Loomis Blvd., Chicago 36, Illinois

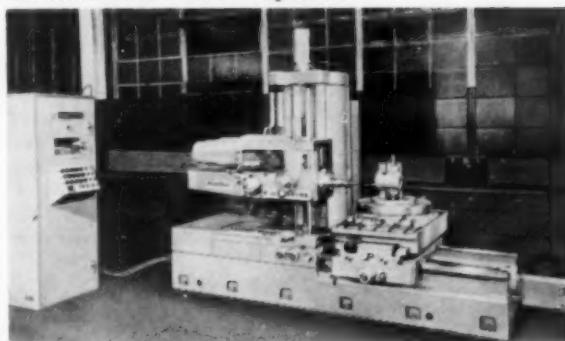
Use postpaid card. Circle No. 357

## Tape Control Horizontal Mill With 3 $\frac{3}{8}$ " Spindle

The new Portage horizontal milling, drilling, and boring machine is available with 3 $\frac{3}{8}$ " spindle. Tape console and position measuring unit is a Warner and Swasey Tele-Probotmat System. Tape is standard 1" eight channel paper or mylar with binary code numerical data prepared with Freiden Flexowriter or with Warner and Swasey key punch. Tape reader can be used with key punch to duplicate tapes if desired. Read-out units on each axis position to .001 with repeatability to .0005. Standard tape system is three axis for control of head, table, and saddle movements. Control and drive is applied to each axis in sequence only for accuracy and for simplification of part work planning. Numerical positioning input information can be dial input or tape input.

Automatic programming through the tape will control the machine through all movements required by a tool, including positioning the work in three directions as many times as required; start or stop feed in either direction; start or stop rapid traverse in either direction; engage or disengage feed drive in any axis; start and stop spindle rotation. Auxiliary functions such as coolant start and stop and automatic clamping, etc., are also included.

General machine data includes: 3 $\frac{3}{8}$ " spindle diameter with No. 5 Morse taper, P.D.Q. or No. 40 taper. Spindle traverse is 24" with hand feed and power feed. Table size is either 28" x 44" or 36" x 74"; table travel 30" or 60". Head travel up and down is 30" or 48"; saddle travel in and out 24", 48", or 72" depending on bed length. On a standard size machine with a 28" x 44" table, 30"



Automatic programming through the tape will control the machine through all movements required by a tool.

column and 52" bed, the tools in the spindle can work within a cube 30" x 30" x 24"; with the tailstock removed, 30" x 30" x 30". A machine with a 36" x 74" table, 76" bed, 48" column, work can be done on parts to 48" x 60" x 48".

Separate spindle drive and feed drive motors offer a maximum of power to the cutting tools at all speeds and provide a flexibility of feed motions required for economical tooling. Infinite variable feed rate permits control of surface finish and chip load. Full range of all feeds is from 100" to 0.20" per minute. Portage double rack and pinion, with heavy duty double row ball thrust bearings on the spindle, provides for feed-in and out of the spindle. This open center design permits heavy thrust loads without distortion in that the thrust load is directly transmitted. The feed drive for movement of the head, table, and saddle is by separate motor in the bed and is infinitely variable for selection of optimum feed rates. This drive is by variable speed motor and two electric clutch reductions for an over-all range of 512 to 1. The rapid traverse rate is the high feed rate of 100" per minute and is automatic without changing the feed rate setting.

Portage Machine Co., 1037 Sweitzer Ave., Akron 11, Ohio.

Use postpaid card. Circle No. 110

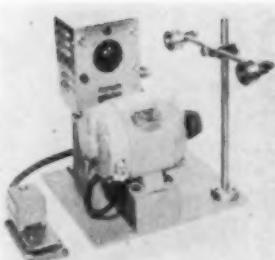
### Electronic Motor Drive Unit

This unit contains no tubes, and the motor can be stopped or reversed at any speed. Speeds range from 0 to 4000 rpm. Dynamic braking is a standard feature. The unit can be supplied with a double shaft to run the idler pulley and stand and lathe from the same motor.

Two sizes of units are available—the smaller unit has a  $\frac{1}{8}$  hp motor, the larger, a  $\frac{1}{3}$  hp motor.

F. W. Derbyshire, Inc., 157 High St., Waltham 54, Massachusetts.

Use postpaid card. Circle No. 311



Idler pulley and stand can be adjusted in all directions.

## "CLEVELAND"

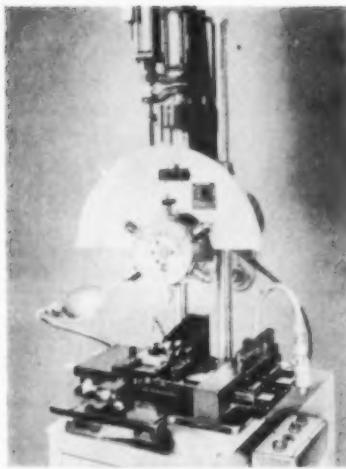
### Rotary Slitting and Side Trimmer Knives

It's the quality of the tool steel plus 40 years of "Know How" that insure CLEVELAND KNIFE users of complete satisfaction. "CLEVELAND" Knives are made in "Alloy", "Century", "Peerless" and "High Speed" grades to meet every metal cutting condition.



**THE HILL ACME COMPANY**  
CLEVELAND KNIFE DIVISION  
6402 Breakwater Ave., Cleveland 2, Ohio

Use postpaid card. Circle No. 358



Controls permit manual, semi-automatic, or fully automatic operation.

### Turret Drill & Positioning Table Speed Precision Drilling

A new bench model automatic six-

spindle turret drill with power feed is synchronized to the controls of an accessory manual positioning table which rapidly locates each hole center within .0005—increasing production. There is no need for jigs and box fixtures.

The machine controls permit three types of operations: manual—operation with power feed; semi-automatic—cycles through a predetermined set of operations, load and unload manually, and fully automatic—cycles automatically using shuttle tables, index tables, hopper feeds, etc. The unitized control panel provides a function selector with "off", "manual", and "automatic", with separate "start" and "emergency up" buttons. Capacity is  $\frac{1}{4}$ " in steel. Working area of the table is 4" front to back, 5" right to left.

Burgmaster Corp., 15001 S. Figueroa St., Gardena, Calif.

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## Self Centering BORE GAGE with INTERCHANGEABLE GAGING HEADS

Will Repeat within 50 millionths of an inch

### AN INEXPENSIVE, ACCURATE AND DEPENDABLE INTERNAL COMPARATOR WITH A LEVER-AMPLIFICATION PRINCIPLE

#### SMALL BORE GAGES

With interchangeable,  
spring-loaded Split Jaw  
Measuring Heads.

Range .050 to .160"	\$110.00
" .160 to .280"	\$ 76.75
" .280 to .400"	\$ 76.75

#### LARGER SIZES

With a springloaded bridge,  
as illustrated.

Range .400 to .700"	\$76.75
" .700 to 1.400"	\$73.50
" 1.400 to 2.400"	\$73.50

Complete in Hardwood case, without gaging head. Additional charge for gaging head reading in .000050" . . . \$37.50.

Also available: • Heads Reading in 20 millionths or 5 tenths.  
• Gages for holes to 32" Dia. • Gages for hole depths to 88".

Mahr, the most complete line of Bore Gages also offers:  
• Precision Comparator Stand for checking of mass-produced small parts.  
• Right-Angle Bore Gages for hard-to-measure places.  
• Tungsten Carbide tipping of extensions and contact points.

GUARANTEED (Mahr) QUALITY

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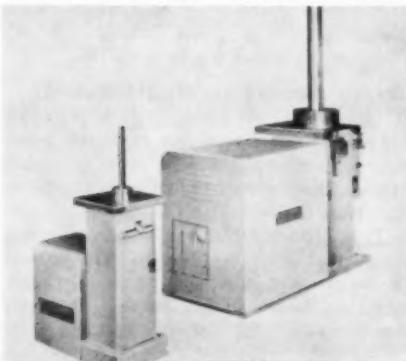
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MACHINE and TOOL BLUE BOOK

### Keyseater Cutting Machines

Two new keyseaters were designed to provide top quality and still give economic production even for short run jobs where setup time is a constant requirement. Accessories are optional.

The larger keyseater (right), M & M's new No. 6 hydraulic, has a cutting capacity of  $3\frac{1}{2}'' \times 30''$ . It not only cuts internal keyways but, with simple fixtures, will cut splines, serrations, and



die profiles, internal and external. Infinite variable cutter speeds, automatic feed and tool relief, and simplified operation are other features reported.

The smaller, inexpensive model No. 1 (left) is mechanically operated and has a cutting capacity of  $3\frac{1}{4}'' \times 8''$ . Machine is ideal for use in either large or small shops.

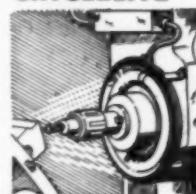
Mitts & Merrill, Inc., 1009 South Water, Saginaw, Mich.

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"Donut"-type fluorescent fixtures direct light into work without heat, shadows, obstruction. Wide application . . . easy installation . . . free literature.

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6771 E. McNichols • DETROIT 12, MICH.

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October, 1960

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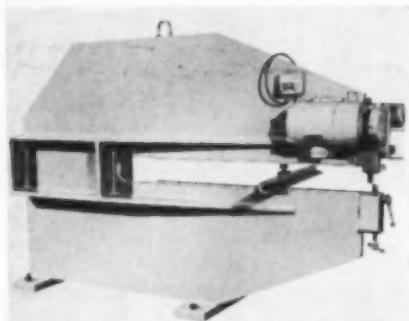
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MACHINE TOOL CO.**

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"High Quality—Low Cost—For Over 50 Years"

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265



Model C-2 heavy duty production machine permits working heavier plate in manufacturing operations. Larger capacity—7/32" in mild steel; 1 1/2 hp motor; 49" throat depth.

#### **Shearing & Forming Machines For 14 Ga. Up to 7/32" Cap.**

The American Pullmax Co. has announced a new economy line of five universal shearing and forming machines. With prices starting at \$400, this line offers an economical method

of straight, circular, and irregular shearing, plus slotting, folding, beading, joggling, edge bending, and louver cutting.

Pullmax machines are used in sheet metal shops, schools, engineering departments, model shops, and in plants where small production runs on a Pullmax machine eliminate costly dies. Capacities of the new line range from 14 ga. up to 7/32" in mild steel.

American Pullmax Co., Inc., 2455 North Sheffield Ave., Chicago 14, Ill.

Use postpaid card. Circle No. 115

#### **Super Sensitive Drilling Unit With .004"-5/32" Drill Capacity**

Lloyd Tool Corp. has recently commenced manufacturing low priced, small, super sensitive drilling machines in three models.

The Model 200 illustrated, of semi cast steel, has a built-in Variac infinitely variable speed control. Infinite variable speeds from 2000 to 11,000 rpm are provided. The precision spindle is

#### **ENGINEERED MIST COOLANT EQUIPMENT**



2349

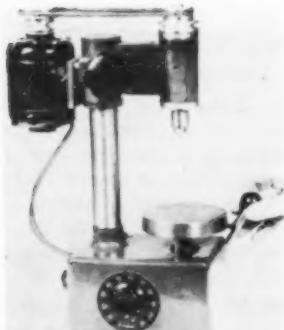


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LUBRICATING CORPORATION  
Rochelle Park, New Jersey

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Over-all height, 17"; base size,  
5 1/2" x 6".

designed to take all standard W.W. jeweler's chucks, collets, and attachments. It is reported that a maximum precision spindle run-out of .0002 is guaranteed.

Vertical travel of the 4" dia. table is 1 1/4". Over-all height is 17"; base size, 5 1/2" x 6"; weight, 36 lb. Drilling capacities are .004" to 5/32". Sturdy cast

pulley guards are optional equipment.  
Lloyd Tool Corp., 3330 E. Colorado Blvd., Pasadena, Calif.

Use postpaid card. Circle No. 116

### Poppet Operated 1/4" Four-Way Air Valve

The Novi-Matic 1/4" four-way Model 25 has fast and positive action, and never leaks air. Because all pipe connections are in the same plane, the valves may be stacked. No lubrication is required. The slide valve, made of DuPont Teflon, requires only 6 lb. force to actuate while using 100 lb. line pressure.

Models 750 and 500 bleeder type poppet valves actuate the above valves. When ball is depressed to actuate the four-way valve, the Novi poppet valves are said to expel air faster and allow air to escape past the ball keeping foreign matter away from vital parts.

Novi Tool & Machine Co., 25806 Novi Rd., Novi, Mich.

Use postpaid card. Circle No. 117

### MASTER WORKMANSHIP REQUIRES

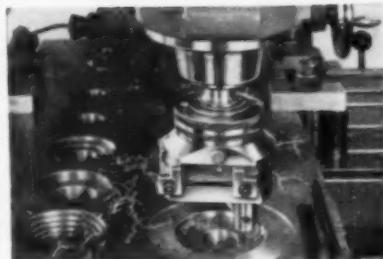


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BORING - TURNING - RECESSING - UNDERCUTTING - TAPER CUTTING

### WOHLHAUPTER Universal Facing & Boring Heads Feature:



- Automatic Feeds and End Release
- 9 Sizes to 36 1/4"
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50,000 RPM

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IN U.S.A.



Weight, 12 ounces;  
length, 6½ inches;  
chuck size ½ inch.  
Wheel guard removed.  
for better illustration.

Here is a fast approach to saving valuable tool room hours. Designed by toolmakers for toolmakers, this reliable off-hand grinder is still the top drawer tool in thousands of tool rooms everywhere.

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**MADISON-KIPP CORP.**

207 Waubesa St., Madison 10, Wis., U.S.A.

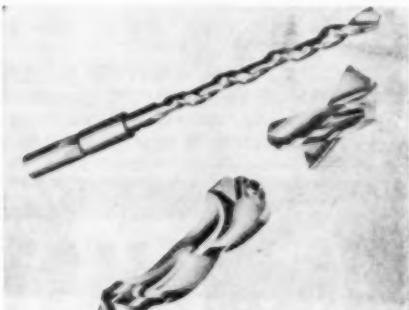
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268

### **Oil Hole Drills With Throw-Away Tips**

A new type of oil hole drill, the Bi-Tip drill, features two flute replaceable tips available in carbide tipped, solid tungsten carbide, or solid high speed steel. After repeated sharpenings have expended usable cutting tip area, a new tip can be brazed to the undamaged body.

The single flute body has margin and land for high durability. The design of the single flute body assures maximum chip clearance that is effective in deep hole drilling of aluminum. Regardless



of drill diameter (5/16" to 1"), there are two coolant holes for even and constant flow of coolant to the cutting lips. The design of the drills permits drilling the entire depth of a hole with one pass.

When specified, the drills will be supplied with Tru-Kut radius points, designed to assure self-centering, free-cutting, greater accuracy, and better finish.

The Bi-Tip drill is especially designed for aluminum, but has also proved effective for drilling in cast iron, bronze, and steel.

Detroit Reamer & Tool Co., 780 W. Maple Rd., Birmingham, Mich.

Use postpaid card. Circle No. 118

MACHINE and TOOL BLUE BOOK

## Tool Used in Forming Soft Tubing By Hand

The Metl-Former was originally designed to roll or bend light rod, tubing, or strip stock as an aid to students in school shops in their metal working assignments. But, industry is now interested. Several firms which produce equipment requiring quantities of tubing to be hand bent and fit are now using the tool to reduce production time and cost. The complete tool contains a clamping vise, vise jaws, a bending wedge, and interchangeable rolls for rolling tubing or flat strip stock. Present low price is maintained.

Swayne, Robinson & Co., Richmond, Ind.



Now used in industrial fabrication.

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POWER HACK SAW BLADES  
HAND HACK SAW BLADES  
HACK SAW FRAMES  
BAND SAW BLADES  
HOLE SAWS  
FILES



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## Bender Handles Large Sized Extra-Heavy Pipe Or Thin Wall Tubing

A new model rotary bending machine is designed to meet the heavy bending requirements of the automotive, boiler, farm equipment, aircraft, and other industries. When set up for bending heavy materials, the machine is called the Model 6 and will handle production bending of extra-heavy steel pipe up to 6", channel to 9" x 15 lb., square steel bar to 4 1/4", round solid steel bar to 5" diameter, and steel angles to 8" x 8" x 3/4". When the machine is adapted for handling thin wall tubing as used in the aircraft industry, it is known as the Model A-8, and is capable of bending tubes up to 8" O.D. with wall thicknesses up to .250" wall steel tube.

Both versions of the machine feature smooth hydraulic operation, economy and versatility of tooling, fast change-over in set-up, convenient work height, and dependable bend accuracy within



Model 4-8 bending machine in use bending thin-wall stainless steel missile ducting.

$\pm 1/2^\circ$ . Each phase in the bending cycle is controlled separately by a multiple push button control station that allows stopping and starting at any point in the bending cycle.

A new direct acting pressure die, available as an accessory, provides extreme accuracy on short radius, ultra-thin wall bends.

Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill.

Use postpaid card. Circle No. 120

## Complete Spring Winding Set

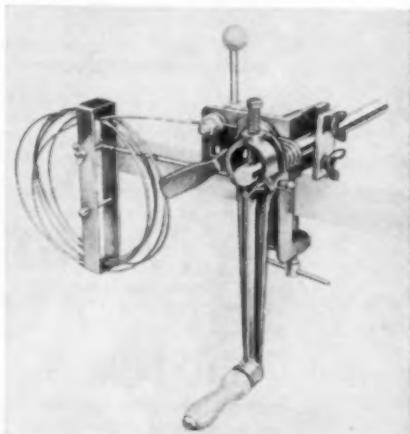
The new Porter complete spring winding outfit provides for quickly winding extension, compression, and torsion springs accurately. The set includes the Model P-2 Porter spring winder, the Hook-Kon spring looping tool for forming end loops on springs up to 1/2" dia., and the Multi-Power nipper for cutting springs after winding.

Springs which can be wound include all sizes from 1/8" to 1 1/4" inside dia., with either right- or left-hand coils in wire sizes up to 3/16" dia. tempered spring wire.

Set sells for \$56.00.

Advance Car Mover Co., Inc., Appleton, Wis.

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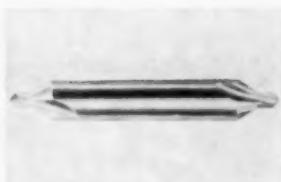


Spring sizes 1/8" to 1 1/4" I.D. can be wound.

### Carbide Center Drill-Countersink

Dixie Tool Industries, Inc. has added a solid carbide combined center drill and countersink to its standard line of carbide cutting tools. It has been specially designed to operate and cut in extremely hard metals where normal high speed tools will not be effective; also for highly abrasive applications. Tool has a double end, 60° included angle and right hand cutting. It is part of Dixie's 710-A series. Six different sizes.

Dixie Tool Ind., Inc., 4555 W. Franklin St., Bridgeport, Michigan.

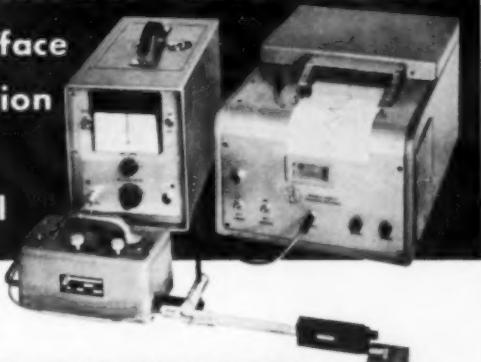


Cuts in extremely hard metals.

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### IMPORTANT NEW "TOOL"

for Surface  
Inspection  
and  
Control



The

### MICROCORDER

The Microcorder draws magnified surface roughness profiles that show (1) *peak-to-peak spacing* and *peak-to-valley height* of roughness irregularities and (2) *width* and *depth* of pits, scratches, chatter marks and surface porosity. It is simple to operate, and is designed for use in shop or lab — on metals, paper, plastics, etc. — for any length of trace up to 2 3/4" on ID's, OD's and flats.

FREE BULLETIN LT138 gives specs. Write —



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For drilling, tapping, milling, sawing, grinding, etc. Removes heat from cutting edges of tools and work. Feeds can be increased considerably, finer finishes and accuracy are obtained. TRICO-MIST absorbs heat, thereby quenching it faster than flood coolants which only transfer it. Chips slide freely up the tool face and are blown away automatically. Simple needle valve controls size and volume of mist spray. Attaches to shop air line. Available with one and five gallon containers—single or multiple outlets—single or dual valve control.

SEND FOR BULLETIN 37

TRICO FUSE MFG. CO.  
 MILWAUKEE, WIS. U.S.A.

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### Packaged Kits of Six Carbide Face Mills

Packaged kits of six carbide face mills with integral  $\frac{3}{4}$ " shanks, called SixPac Kits, are packed in pairs in protective wood cabinet. These kits are being introduced in various combinations for machining aluminum, steel, cast iron, stainless steel, and plastics.

The complete package containing two each of  $1\frac{1}{2}$ ", 2", and  $2\frac{1}{2}$ " diameter cutters, including cabinet, is available in paired combinations at \$115 for six cutters.

Niagara Cutter, 330 Niagara St., N. Tonawanda, N.Y.

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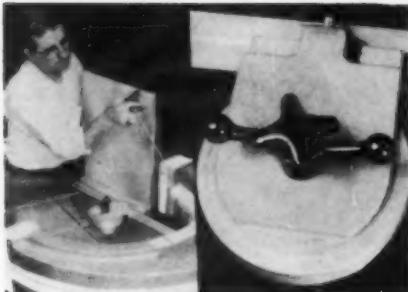
### Master Protractor And Aluminum Angle Plate

A new master protractor and aluminum angle plate have been announced.

The protractor locks quickly and securely into slots and keyways in either vertical or horizontal position. Angle setting is made from graduations and vernier on the face after protractor base is rigidly locked into position. It is adaptable to various sizes of slots (from  $\frac{3}{8}$ " to  $1\frac{1}{16}$ ") and interchangeable to inspection tables, planers, mills, bars, etc.

Used in conjunction with the 18" x 20"

Gaertner Optical Instrumentation  
designed and manufactured in the U.S.A.



faced aluminum angle plate (weight approx. 40 lb.), lay-out time is claimed to be reduced at least 50%. The manufacturer also reports a guaranteed accuracy (to five minutes of a degree) and elimination of possible error with standard protractor.

Accurate and slotted lay-out tables are also available.

K-M-P Tool Co., 321 Highland Ave., Beloit, Wis.

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Another

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Karat	Regular Price	New Price
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1/2	12.00	5.00
3/4	21.00	7.50
1	30.00	10.25
1 1/2	54.00	15.00
2	75.00	20.00
2 1/2	102.00	26.00
3	130.00	32.00

These diamonds can be set in any shank to your specifications for \$1.00 each extra.

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## Coordinate Cathetometers reduce inspection time

Gaertner Coordinate Cathetometers are reliable optical instruments for making precise measurements in the vertical plane. Because they permit reading two coordinates in a single setting, they reduce inspection time and eliminate resetting errors.

In addition to the routine inspection applications, these instruments permit measurements on larger objects as well as objects or points in recessed, remote or inaccessible locations. They eliminate the errors and indecisions associated with mechanical-contact measurements.

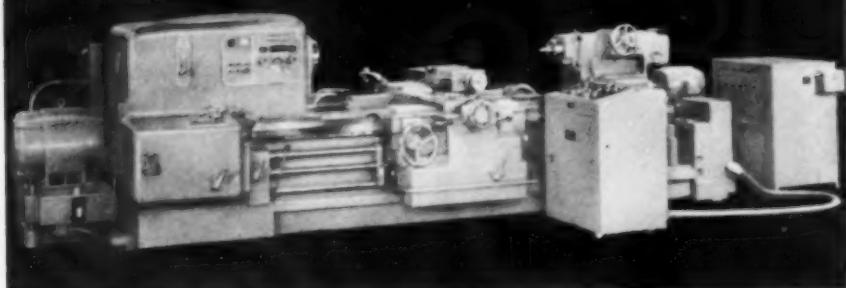
Illustrated is Gaertner's M1238-1818 instrument. It has a range of 18" x 18", working distance of 9" to infinity, and reads to 0.001" up to 24" working distance. Protractor ocular reads up to 3 minutes of arc. Larger ranges are available. Smaller types provide reading to 0.0001".

Write for Bulletin 194-57

Use postpaid card. Circle No. 367

1221 Wrightwood Ave., Chicago 14, Ill., BU 1-5335

**Gaertner**  
SCIENTIFIC CORPORATION



New Series 91 heavy duty Dyna-Shift lathe equipped with the Electro-Gage Tracer. The lathe features power shifting and four-way variable speed, hydraulic power traverse.

### New Universal Tracer System Shown In Use On New Lathe

The new 360°, two-axis, electro-hydraulic tracer system, called the Monarch Electro-Gage Tracer, features absence of contour limitation except as might be created by the cutting tool. It is recommended for machining work-pieces of any kind having complex contours. It can only be applied on new lathes at the factory.

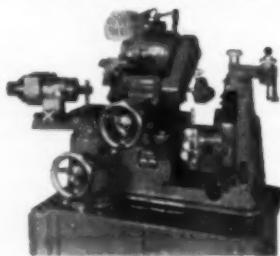
The tracer head utilizes a variable

reactance device which sends signals to an electronic control console for interpretation and amplification. Modulated signals from the console provide electro-hydraulic servo valve control for regulating oil flow to the hydraulic motors. The electronic equipment is in the form of fully transistorized plug-in modules for ease of maintenance. Console, which is on casters, may be

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Sharpens Chamfers, Flutes  
and Spiral Points



Model 1100

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- 11", 13" and 18" table sizes
- Choice of 2 or 4 speeds or infinitely variable, 100 to 475
- Improved overarms
- You can dial correct speed and stroke with Model FS-VSS

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located conveniently to the operator because here is his complete electrical control center.

Lathes equipped with the Electro-Gage Tracer may be used for conventional operations as the hydraulic motors for driving the leadscrew and the cross feed screw are disconnectable. In such a case, the regular carriage power rapid traverse of the machine becomes operative.

The new Series 91 Dyna-Shift heavy duty lathe has the weight, power and general features for metal removal limited only by the tool and the characteristics of the work piece.

Major feature is the exclusive Dyna-Shift headstock. With it the operator works in terms of surface cutting speed; the machine automatically calculates the correct r.p.m. and sets up the shift. Only two dials need be set—one for work diameter, the other for desired surface speed. Power shift from one speed to another is quick and effortless.

36 speeds are available, ranging in geometrical progression from 6 to 750 r.p.m.

Electricals are mounted externally for simplified maintenance. Main drive motor is in the 40 to 60 h.p. range. Drive to the headstock is through multiple "V" belts.

Bed way design provides chutes which lead chips into open pan at rear, thus simplifying chip removal.

End gear train and gear box are totally enclosed. A total of 48 thread and feed changes may be secured. A time saving feature of considerable consequence is the four-way, variable speed, hydraulic, power traverse to the carriage and cross slide.

The Series 91 is offered in three models—4025, 4025-31 and 4025-36. A wide assortment of accessory equipment is available including the Monarch "Air-Gage Tracer".

Monarch Machine Tool Co., Sidney, Ohio.

Use postpaid card. Circle No. 126

October, 1960



## **KENTRALL** **Hardness Testers** **Are Motorized**

By removing major test loads automatically, the new motorized Kentralls reduce operator error, increase reproducibility of test results, and raise the productive capacity of the machine—for the same price as hand operated testers.

The motorized Kentralls are available in Combination Testers which provide both Regular and Superficial Rockwell Hardness Testing in a single machine. For those applications that do not require the additional range, Kentrall also makes single purpose testers for either Regular or Superficial testing alone.

**For complete information write  
for Bulletin CRS-60.**

**KENTRALL**  
**THE TORSION BALANCE COMPANY**  
*Main Office and Factory:*  
**CLIFTON, NEW JERSEY**  
*Sales Offices: Chicago, San Francisco*

TS-164

Use postpaid card. Circle No. 370

275

# Angle Tangent to Radius WHEEL DRESSING Simplified

WITH  
ROTHFUSS TOOLS



### THE G-5

#### RADIUS DRESSER

is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on all wheels up to 10" and it may be set to the exact radii desired. Graduated stops allow you to dress any desired portion of a radius. The spring tension journal insures chatter free operation. Price \$80.50



Price \$87.50

### THE G-2 ANGLE DRESSER AND TOOL HOLDER

is actually two tools in one, having an easy to read vernier scale 0° to 180° giving accuracy within 2" of 1°; an excellent time saver to set up jobs to be milled, drilled, tapped on any desired angle.



All for only  
**\$149.50**

(including case and both tools with diamonds)

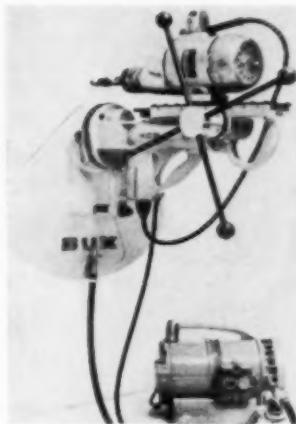
Distributorship available in select territories

**ROTHFUSS TOOL**  
COMPANY

BOX 2694 ELMWOOD STATION PROVIDENCE 7-2111

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276



3000 lb. grip holds drill base.

### Vacuum Pump Creates Suction Base For Portable Drill Press

The new Bux Vacu-Press portable drill, made by Bux Magnetic Products, Inc., 1355 N. 10th St., San Jose, Calif., is mounted on a base that is, in effect, a giant suction cup. A flexible neoprene rubber seal is built in around the edge of the base so that, when air is drawn from the base by the vacuum pump, a vacuum is created inside that holds the whole unit securely against the wall.

The Bell & Gossett oil-less vacuum pump creates a vacuum that puts a solid 3,000 lbs. of holding force into the drill unit. Four pumps are available in the series. Lowest cost one-cylinder unit displaces 2.7 cu. ft. per min., and is priced at \$63.75. A more powerful, two cylinder unit, displaces 6.57 cu. ft. per min. Price is \$127.

Vacuum pump used with Bux Vacu-Press is included in \$297.50 of new drill stand. Drill itself is not included, but the stand will mount almost any make or model drill, air, or electric.

Bell & Gossett Co., Morton Grove, Illinois.

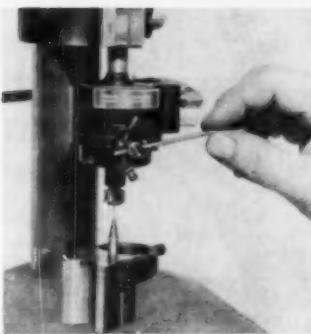
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MACHINE and TOOL BLUE BOOK

## Miniature Drill Converts Machines to Small Hole Drilling

Turbo-Drill, driven by a high speed air turbine, can be mounted in any standard drill press, jig borer, miller, or lathe. The unit permits accurate drilling of holes from 0.032" down to 0.001" dia. It incorporates a pneumatic down-feed that can be adjusted to suit drill being used, eliminating need of special operator skill. In typical operation, the air turbine runs at speeds from 3500 to 120,000 rpm.

Milburn Machine Works, 203 Milburn Ave., Baldwin, L.I., N.Y.



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the names that stand for **production**  
in the metal-working centers of America

**air hard**



**ohio die**

**crocar**



These are the most profitable cold work die steels at the disposal of the diemaker today, in down-to-earth *performance per dollar per pound*. Each is an air-harden grade, each has its unbeatable area of application. Only three names to remember—AIR HARD, OHIO DIE, CROCAR—and you've got it made! *Check us for the technical data you can use.*



**Vanadium-Alloys Steel Company**

LATROBE, PENNSYLVANIA

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## FLUID POWER

"a young industry  
with a  
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An opportunity to learn Theory, Fundamentals of Operation, Application, Diagnosis and Repair of all types of Hydraulic and Pneumatic equipment, and controls.

**Mr. Manager:** Some of your good men could be "up-graded" and made even more valuable with this training. Consider company sponsored group training—it pays. Send for our literature.

**TRAINING for INDUSTRY DIVISION**  
P.O. BOX 120 LOGANSPORT, INDIANA

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### All Geared Headstock Lathes Offer 12 Spindle Spds 20-900 RPM

C & J Master model lathes, with all geared headstocks, are suited for general service including tool and die work, and numerous machine shop applications.

Twelve spindle speeds from 20 to 900 rpm are obtained through two speed handles. The headstock is lubricated by a splash system, with all parts running in a constant oil bath. Oil level is



Master Model GH 16" lathe has big lathe design.

checked by means of a window type oil indicator.

A new improved friction type clutch and brake controls the spindle, allowing the motor to run continuously. Clutch and brake control handles are conveniently placed, and the apron control handle on 10", 12", 14", and 16" lathes permits spindle control from the apron at any position along the bed. At 100 rpm, the front spindle bearing takes a 6622 lb. radial load, a 5227 lb. thrust load. The rear spindle bearing takes a radial load of 5681 lb., and a thrust load of 3776 lb.

Two different sizes of lathes are available—the Master Model GH 16", and the Master Model GH 18".

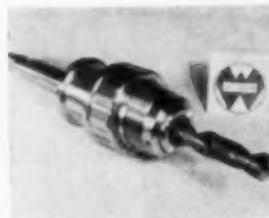
Carroll-Jamieson Machine Tool Co., Dept. 1, Batavia, Ohio.

Use postpaid card. Circle No. 130

### Positive Control For Depth of Hole

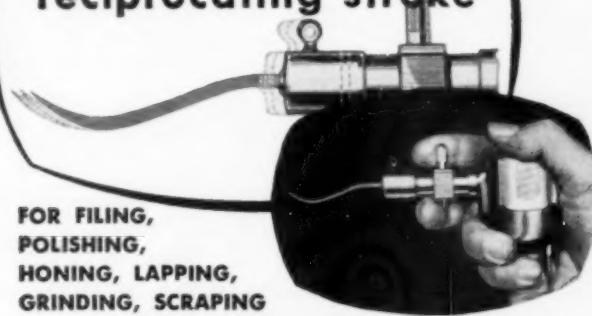
The precision Micro Drill Stop, with no collets required, is said to afford instant precision adjustment. Its main function is to end guesswork and costly rejects by giving precision hole depth control with consistent hole depth accuracy automatically, without human error. The drill stop can be used for drilling, counterboring, countersinking, reaming, etc., on drill presses, radial drills, lathes, hand and automatic screw machines, and boring machines. It may be used horizontally or vertically.

Wohlnip Products, Inc., 634 Central Ave., E. Orange, New Jersey.



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use this  
precise, adjustable  
reciprocating stroke



FOR FILING,  
POLISHING,  
HONING, LAPING,  
GRINDING, SCRAPING

## THE Di-Profiler

### Flexible Shaft RECIPROCATING TOOL

Saves costly hours of tedious hand labor on concave, convex and flat surfaces—and especially on hard-to-reach details of dies, molds, tools. The fast, precise reciprocating action can be varied from 0 to 100 strokes per second, with length of stroke from 0 to  $\frac{1}{4}$  inch. Moderate in price, the Di-Profiler, with its many versatile accessories, pays for itself quickly through time-saving cost reduction.

Write for free demonstration or illustrated price list DT-100

**HYPREZ DIVISION  
ENGIS EQUIPMENT COMPANY  
431 South Dearborn Street, Chicago 5, Ill.**

Use postpaid card. Circle No. 373

## **Solid Carbide Tool Sizes Small Holes in Toughest Metals**

A new solid carbide tool, called the Microtron, is specifically designed to size small holes in the toughest metals with utmost accuracy. It is reported to size holes in oilite, stainless steel, beryllium, inconel, molybdenum, and tool steel to tolerances of .00005" or better, while imparting excellent finishes. Its new single-edged design is said to allow for greater precision than previously obtained with ordinary reamers; also, its greater cross-section provides greater rigidity and strength.

Standard sizes are available in 1/32, 1/16, 3/64, 3/32, and 1/8. Special sizes will be made to order ranging from .0250 to 1.600.

Microtron Tool Corp., Two Manhasset Ave., Port Washington, N.Y.

Use postpaid card. Circle No. 132



## **Cobalt Super High Speed Drills**

The Union Twist Drill Co. announces the stocking of a complete line of cobalt super high speed drills in both wire and jobber lengths and in taper shanks. These drills are made of premium T-15 steel and are especially abrasion resistant. They are recommended for the drilling of the newer and harder missile metals. Drills are in stock and priced at regular cobalt drill prices.

Union Twist Drill Co., Athol, Mass.

Use postpaid card. Circle No. 133

# **proven**

# **BACKUS CUT-OFF MACHINES**

For High Speed Cutting of All Types  
of Metals and Materials

At Any Angle!

III. Model 1260



8", 10" & 12"  
Abrasive and  
Non-Ferrous  
Models

Since 1914

**BACKUS  
MACHINE WORKS**

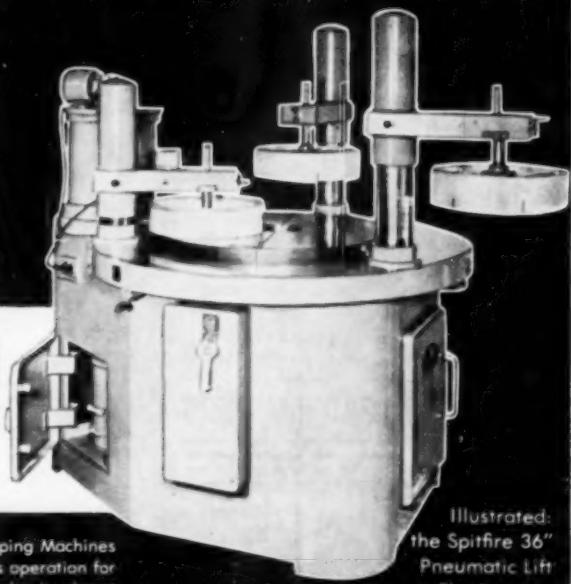
ROUTE 17 DEPT. CT. CARLSTADT, N. J.

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1  
2  
3

# SPITFIRE

## basic reasons 1 Lapping is now a standard



Illustrated:  
the Spitfire 36"  
Pneumatic Lift  
Flat Lapping  
Machine

**1. PROVED:** Spitfire Lapping Machines have been in continuous operation for approximately two decades in almost every phase of industry... built-in quality and precision, experienced engineering assure demanded reliability.

**2. NEED:** Quality control requirements for lapping to thousandths of an inch precision has become increasingly necessary. Literally any piece part produced of any material is quickly, accurately, economically lapped and/or finished in small or high volume production with Spitfire machines.

**3. COMPLETE LINE:** from small bench type 6" roller lapping machines to 48" pneumatic flat lapping machines.

Write for free Spitfire Catalog.

# SPITFIRE

TOOL & MACHINE CO.  
2931 N. Pulaski Rd.  
Chicago 41, Illinois  
Phone: AVenue 6-1610

Use postpaid card. Circle No. 375



**MUMMERT-DIXON  
FACING HEADS  
with Automatic Feed**

One-way Tool Feed—8, 9 and  
12" sizes.

Two-way Tool Feed—9, 12, 16  
20, 24, 30, 36, 40 and 46" sizes.  
Save many costly set-ups.

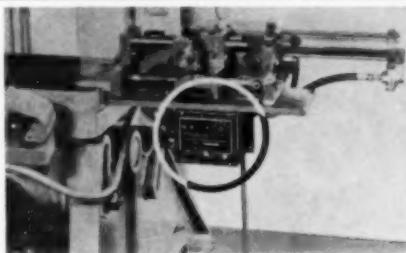
Bulletin No. 4141 Gives Full Details

**MUMMERT-DIXON CO. 122 Philadelphia St., Hanover, Pa.**

Use postpaid card. Circle No. 451

**Automatic Sequence Counter**

Longer feed lengths are now possible from all Cooper Weymouth air operated slide feeds with the addition of this new automatic sequence counter. By feeding longer lengths than rated capacities allow, the usefulness of these air feeds is greatly extended, enabling one model to handle an infinite variety of feed length requirements. In operation, the sequence counter allows the



air feed to advance the stock from one to seven times before the press is stripped. The 24" air feed shown, for example, can automatically feed stock from 1" to 168" in length before the press is actuated.

The automatic sequence counter can be wired directly into an air clutch control panel or can, with the addition of an air cylinder, operate a mechanical clutch press.

Cooper-Weymouth, Inc., 600 Honey-spot Rd., Stratford, Conn.

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**Mold your own LEAD HAMMERS**

Here's the inexpensive, fast way of molding and remolding your own lead hammers with this COOK mold and ladle. It produces hammers that can "take it." Simple to operate.

Write  
for circular  
and prices



**COOK LEAD HAMMER SERVICE**

67 MASSASOIT AVE., EAST PROVIDENCE, R. I.

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IN 11 SIZES—No. 6 to 1"  
N.C. in all S.A.E. sizes.

*You Need an Extra Hand Now  
to Speed Up Production!*

**HEIMANN TRANSFER SCREW SETS**

Here is the faster, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench—no other tools needed. Get more work now—save money tool.

**HEIMANN MFG. CO. • URBANA, OHIO**

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## Linear Vernier Calipers

A new line of linear vernier calipers, precision made from stainless steel, hardened and lapped throughout, are ideal for tool makers, machinists, and inspectors. The vernier scale is deeply engraved for maximum contrast against the satin finish scale for easier reading. A micro-positioning feature simplifies adjustment of the measuring head for faster, more accurate measurement. The calipers feature a double vernier scale which reads either 1/1000" or 1/128", with an accuracy of 1/1000". In durable plastic case.



No. 244 caliper has a 6" scale with effective measuring range of 5". Its double jaws permit convenient inside or outside measuring.

Titan Tool Supply Co., Inc.,  
Box T, 1419 Hertel Ave., Buffalo  
16, N.Y.

Use postpaid card. Circle No. 135



## NEW! MAGNETIC ANGLE IRON HOLDS WORK WITHOUT CLAMPING

Here's another ingenious layout and inspection short cut now available from Taft-Peirce! It's a universal right angle iron and magnetic chuck combined to eliminate the lost time and inconvenience of work clamping and multiple setups.

Work is held firmly in place by energizing the face-plate with a 90° turn of control bar, recessed on each end face. By giving this bar a partial turn, face is slightly magnetized for exact adjustment of work before applying full holding power. Magnetic Angle Iron can be turned on side, back or ends, and faces, sides and ends are precision ground square and parallel within .0002".

**ACT NOW!** Taft-Peirce Magnetic Angle Irons can help save time and money wherever there's setup work being done. In stock now. Write direct for Catalog 711.

TAKE IT TO

TAFT-PEIRCE



7 MECHANIC AVE., WOONSOCKET, R. I.

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### **Extra Depth Hole Saw Kit For Cutting In Wood, Steel, Wallboard**

A handy new kit is announced which provides an assortment of Milford extra depth hole saws to cut entrance holes up to 2½" deep for standard pipe sizes up to 2". These kits include six of the saws ranging from 1-1/16" to 2-9/16" dia. and two arbors with 7/16" shanks, all contained in a sturdy 6" x 4" x 3" steel box. The saw's construction of high speed steel cutting edges welded to tough chrome-vanadium bodies is said to provide a shatter-proof blade that stands up to the roughest use. The Henry G. Thompson & Son Co., 272 Chapel St., New Haven 5, Conn. Use postpaid card. Circle No. 136



## **F R E E**

*to metalworking management!*

## **NEW**

*16-page illustrated booklet*

### **Vapor-from-paper STOPS RUST**

Now, you can "mothball" your metal parts or products as easily as your wife protects her woolens. This new booklet tells how Ludlow VPI® Wrap cuts costs in shipping and storage. Read how other companies have saved by modernizing their preservation methods. It's FREE! Ludlow Papers, Needham Heights, Mass. Dept. 166.



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announcing the NEW  
\*Recirculating **VIBRATRON**

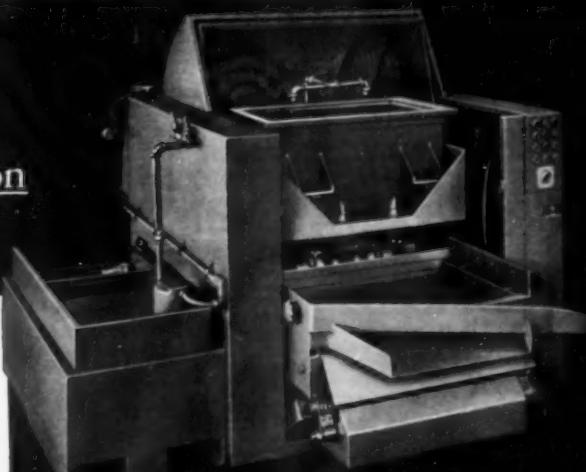
See the  
difference  
Recirculation  
makes!



Processed in Recirculating Vibratron.  
Gleaming! Clean!



Processed in conventional vibratory machine. Notice abrasive impregnation.



This new idea in vibratory finishing pays off in increased production and operating economy. Wastes are removed constantly during the processing cycle, *eliminating abrasive impregnation!* Compound stays clean.

Parts may be deburred, radiused, and cleaned *in one operation*. No separate cleaning cycle needed! Equally important . . . compound can be used for its effective life, lasts up to 48 hours.

The result? The unretouched parts photo tells the story. Both were vibratory finished the same time in the same media.

The top in a recirculating Vibratron. The bottom in a conventional vibratory machine.

*Want to know more? Your inquiry will receive prompt attention. Let's hear from you. Today?*



**ROTO-FINISH/RANSOHOFF**

3715 Milham Rd. • Kalamazoo, Mich. • Phone: Fireside 3-5578

\*U.S. and foreign patents applied for.

**FOREIGN REPRESENTATIVES:** ARGENTINA-Roto-Finish Argentina-Buenos Aires • AUSTRALIA-A. Flavell Ltd.-Cheltenham • BRAZIL-Refema-Roto-Finish-Sao Paulo • CANADA-Canadian Hansen & Van Winkle Co., Ltd.-Toronto • ENGLAND-Roto-Finish Ltd.-Hemel Hempstead • FRANCE-Societe Roto-Finish-Paris • GERMANY, AUSTRIA, FINLAND, NORWAY, SWEDEN, SWITZERLAND, YUGOSLAVIA, JAPAN-Metallgesellschaft A.G.-Frankfurt, a.m.-Germany • HOLLAND, BELGIUM, LUXEMBURG-N.V. Roto-Finish Maatschappij-Delft, Holland • ITALY-Societa Roto-Finish a R.L.-Milan • MEXICO-Enthona de Mexico, S.A. Prol Pina 669, Mexico 15, D.F. • SPAIN-Instituto Electroquimico, S.A.-Barcelona

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## Power Chucks With Large Thru Holes For Bar and Chucking Work

A new power chuck, operated by air or hydraulic cylinder, is designed to provide advantages of a universal hand-operated chuck, plus controlled holding pressure and ease of operation of a power chuck. Other features include: a large center hole, with up to 4" ID., for chucking bars and long thin workpieces; easily adjusted serrated jaws to grip various diameters; greater gripping power, and safer operation. Available are seven standard sizes from 4 1/4" to 16", in two-jaw and three-jaw styles.

PowerGrip, Inc., Rockfall, Conn.

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## The WELLS Model 600 Metal Cutting Band Saw

for  
Tool and  
Stock Room  
Service

•

for  
Medium  
Production  
Jobs



Rugged in design, dependable in operation, the Wells Model 600 is the ideal saw for tool and stock rooms . . . gives excellent service on medium production jobs. Uses  $\frac{5}{8}$ " blade. Adjustable, uniform gravity feed is provided by hydraulic stabilizer and special coil spring. Casters available for portability. Write for Bulletin 260-A.



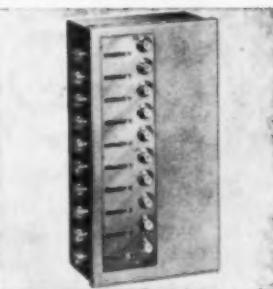
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## Time Utilization Meter Panel For Production & Cost Control

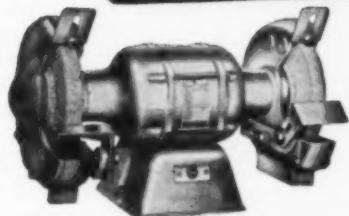
The time utilization meter panel shows, with pilot lights and time accumulation figures, the productive operations of ten individual machines, processes, or operations. The lights make "across-the-room" supervision easy. The six digit figures provide for reading totals at any time. Each individual machine or operation is electrically connected to the meters to show only productive (not merely motor idling) time. The lights come "on" and the figure wheels add up the time.

Gorrell & Gorrell, Westwood, N.J.

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## MOST Value-Packed GRINDER MADE!



only \$112.00

# BALDOR

MODEL 153-8"

Feature for feature, no other grinder offers so much for so little. Compare HP rating, wheel size, shaft diameter, bearing size with any other similar-type grinder. You'll quickly see why you get *more* with *Baldor*!

- Big  $\frac{1}{2}$  HP motor; won't burnout even if repeatedly overloaded!
- Wide-clearance design provides maximum working room!
- Large 8" first grade wheels!
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- Dynamically-balanced rotor—extra smooth operation!
- Exhaust-type guards!

### CARBIDE TOOL GRINDER



Model 153-6". Reversible  $\frac{1}{2}$  HP motor, 3450 RPM.  $1\frac{1}{2}$ " wide wheels. Every part oversize for rugged, long-lasting use. Just \$701.80

Write today for Bulletin 321N on complete line of *Baldor Grinders and Buffers*!

**BALDOR ELECTRIC CO.**  
4353 DUNCAN AVE. ST. LOUIS 10, MO.

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MILLED STUDS

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SCREW MACHINE  
SPECIALTIES

\*W<sup>m</sup>H. Ottmiller Co.  
YORK, PENNSYLVANIA

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## UNEQUALLED

For Small Jig Boring Jobs!

### LINLEY JIG BORER

Made for small precision work found in all sized shops. Meets your most exacting requirements; releases large capacity borers for heavier jobs. Investigate the savings made possible with the Linley Jig Borer. An inquiry card mailed today will bring you detailed information promptly.

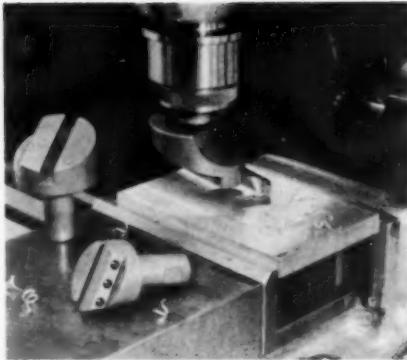
Table Size: 7" x 17½"  
Table Travel: 6½" x 10"



**LINLEY BROTHERS CO.**  
663 State St. Ext., Bridgeport 1, Conn.

Use postpaid card. Circle No. 384

288



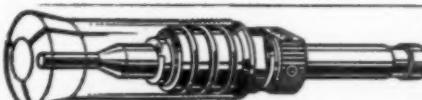
### New Design for Fly-Tool Cutter Holders

A newly improved model of Fli-Kut fly tool cutter holders features a counterbalanced holder said to allow faster speeds, faster feeds, and finer finishes. Unit is furnished in sets of three different sized holders complete with an unbreakable plastic stand.

Using 5/16" carbide or high speed tool bits, Fli-Kut is reported as ideal for rapid stock removal, smooth finishes up to 6" wide in one cut instead of a series of cuts as with end mills. 3/4" shank size on holders makes unit adaptable to most vertical mills.

City Tool-Die & Mfg. Co., Inc., 132  
Spencer Ave., San Jose, Calif.

Use postpaid card. Circle No. 139



### NEW! Self-Centering 5C Collet Stop

Quick friction adjustment. Stays in fixed position. Will not distort collet. Will not move back. Also available for other collets and spindles. 30 Days Free Trial. Several Territories Open for Distributors.

Write for Bulletin.

**THE BYSTROM COMPANY**  
6106 Park Ave. South Minneapolis 17, Minn.

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MACHINE and TOOL BLUE BOOK

You can bore holes round within 20 millionths and bore them FASTER at lower cost with the NEW . . . .



**POPE®**  
**MODEL 10-6**  
precision boring machine

- Table dimensions - 12" x 12"
- Maximum stroke, each head - 6"
- Standard center height - 5 1/2" (variable)

Here are some  
of its advantages:

**Two Heads Are Better Than One.**  
Two Horizontal Boring Heads moving from both directions simultaneously over a stationary work table increase your production. *Two heads working are more profitable than one.*

**Pope Precision Boring Heads** are motor driven and all of their rotating parts are dynamically balanced. Lubrication — Pope System. These precision boring heads run cool, a necessary feature for precision boring.

These and other exclusive features put this Precision Double End Boring Machine way out front for production, precision and profit. *Ask for Bulletin No. S-21.*

**Hydraulic Drives** operate the spindle head slides, and the work table cross slide if desired, assuring smooth rapid traverse, precision fine feed control.

**Uniformly Low Operating Temperature** for the entire machine — added assurance of continuous production of accurate parts.

**New Pope Electric Programmer** is a unified, separate console containing all the electric controls for fast operation; duplicate set-ups can be made quickly.

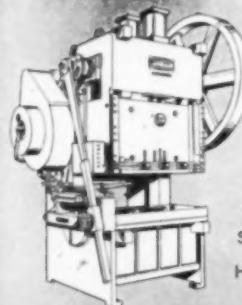
**POPE®**

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

ENGINEERS, DESIGNS AND BUILDS  
PRECISION ANTI-FRICTION BEARING SPINDLES  
FOR EVERY PURPOSE

Established 1920

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Write  
today for  
**BULLETIN**  
1960  
Complete  
"specs" on  
Johnson line of  
Inclined,  
Straight Side,  
Gap and  
Horn Presses.

**GAP**

*Johnson*  
POWER PRESSES

JOHNSON MACHINE & PRESS CORP.  
620 W. INDIANA AVE., ELKHART, INDIANA

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## Grinds Flutes

Model  
90FS



AUTOMATICALLY

Makes twist  
drills, spiral or  
straight reamers,  
end mills, cut-  
ters, and  
other carbide  
tools from solids.

Also  
sharpens  
saws

Write  
for  
Bulletin

**WARDWELL**  
MANUFACTURING CO.  
3807 Ridge Road Cleveland 8, O.

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290

## A CONTROLLED BLOW Saves TIME, EFFORT and MONEY

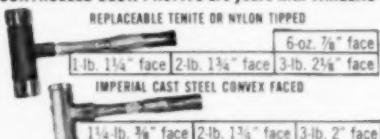
**T**Supply your machinists with  
**TAHLEN NO-BOUNCE HAMMERS**

Prove, in your own plant, why this imitated, but never equalled hammer has saved millions of man-hours for its users. Plastic tipped TAHLENS have all the advantages of lead hammers but none of their faults. No flying fragments, no distorted faces that cause misplaced blows.

And for fastening and drilling. Cast Steel TAHLENS with their high impact, replace mauls twice as heavy—save time and energy.

**CONTROLLED BLOW PROFITS** are yours with TAHLENS

REPLACEABLE TENITE OR NYLON TIPPED



Write for the Tahlen distributor in your area  
Dept. M-10 **TAHLEN HAMMER CO.**  
1729 1st South, Seattle 4, Washington

Use postpaid card. Circle No. 390

## TORQUE WRENCH MANUAL



Sent  
upon request

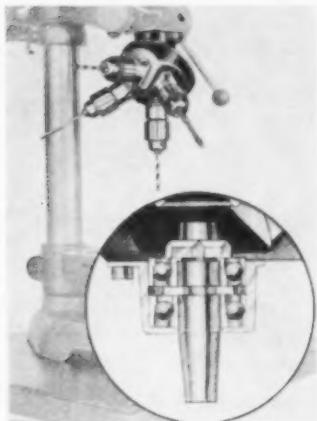
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Applications  
Engineering data  
Screw torque data  
Adapter problems  
General principle

**P.A. STURTEVANT CO.**  
ADDISON **QUALITY** ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

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MACHINE and TOOL BLUE BOOK



Improved Quadrills convert drill press to precision turret drilling machine.

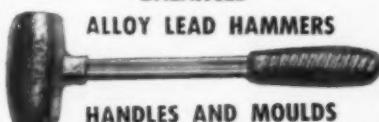
#### New Spindle Assemblies For Quadrill Turret Drilling Heads

Chicago Quadrill announces new precision spindle assemblies as standard equipment on all models of four and five position turret drilling heads. Each spindle is mounted on two preloaded ball bearings featuring zero clearances for greater rigidity, accuracy, and longer life.

The newly improved Quadrills quickly convert practically any drill press into a precision turret drilling machine.

Chicago Quadrill Co., 1846 Busse Highway, Des Plaines, Ill.

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#### HANDLES AND MOULDS

1, 1½, 2½ and 5 lb. sizes—order your alloy lead hammer requirements from your mill supply house.

or direct from:

**KITZMAN MFG. CO.**  
Manufacturers Of Lead Hammer Products  
15061 Hartwell Ave. Detroit 27, Mich.

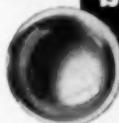
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October, 1960

## Enco Turrets Assure $\pm .0005"$ Accuracy



by  
being  
on the  
ball!



Enco's passion for exacting accuracy is paying off in metal working operations everywhere! Combining precision lathe output with efficiency and economy has become a necessity . . . and Enco turrets have proved the ideal answer. An Enco turret transforms one lathe into a production machine, each operation of unsurpassed accuracy due to *spring loaded ball design!*



Spring loaded balls give you the accuracy you want! Hardened steel precision balls locked between accurately milled spherical seats consistently give accuracy in re-indexing. Hardened all steel construction minimizes wear, retains built in precision.

Also Mfrs. of Enco Hexaturret Bed Turrets  
Write today for catalog No. 53.

There's an ENCO turret for every lathe.

**Enco** MANUFACTURING CO.

4520 West Fullerton Avenue  
Chicago 39, Illinois Dept. 2100

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# NEW FLYNN

"60"  
SERIES

## OFFSET BORING HEADS



This new precision offset boring head is designed for  $\frac{1}{8}$ " to 1" bar capacity. Features long, stocky tool block for securing the tool. Vernier simplifies close visual adjustment.

**INTERCHANGEABLE ARBORS AND SHANKS  
SAFETY ROUND CONTOURS**

Complete Line of Boring Heads and Tools

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**FLYNN MANUFACTURING CO.**  
18301 WEAVER, DETROIT, MICHIGAN

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that it's PARALLEL?  
... STRAIGHT?  
... SQUARE? ... FLAT?

You will be if you use "Milwaukee" Precision Equipment—Surface Plates, Straight Edges, Angles, Box Parallels. Standard of the industry!



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### Electrochemical Etcher For Marking Metals

The "Bantam" has been designed for fast permanent markings in a few seconds on jet blades, gears, bearings, saws, drills, taps, reamers, etc. No distortion of work, no displacement of metals, no stress or strain on metals, and no deformation or burs are advantages claimed for the etcher. Stencils can be prepared on standard typewriter, Vari-typer, or with stylus.

The compact portable unit is contained in a handy carrying kit. Other electrochemical etching accessories are available on request, built to customer specifications.

Price is \$49.95 f.o.b. Milwaukee.

Pavlic Engineering Sales, 149 N. 74th St., Milwaukee 13, Wis.

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Your Lubricants**

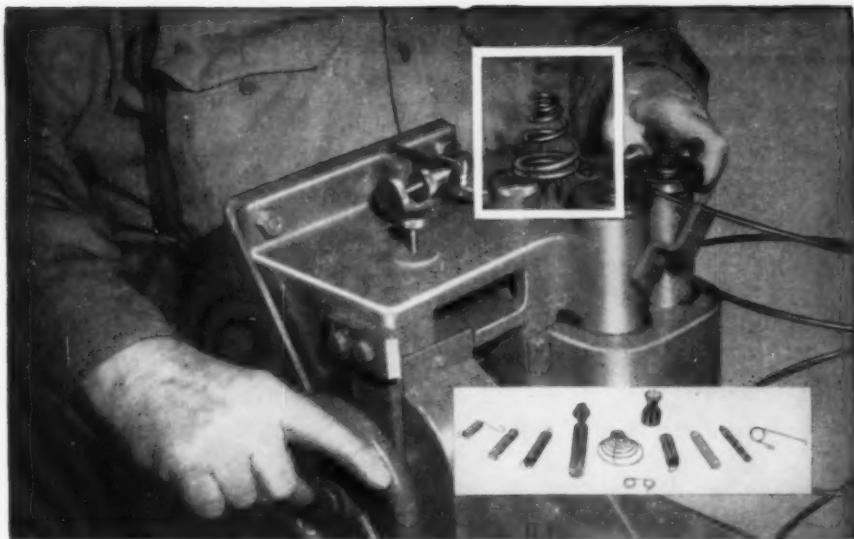
**MOTOR MICA**  
MILWAUKEE, WIS.  
ANTI-FRICTION  
COMPOUND

A clean white powder. Improves cutting oils. Dies last longer. Solves tough lubrication problems. Ask for free samples.

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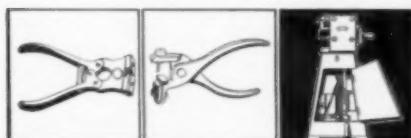
MACHINE and TOOL BLUE BOOK



## Any spring made fast in your shop! WITHOUT USE OF ARBORS

For a replacement or experimental spring, any shape, diameter or pitch from flat or round wire sizes .005" to .125", you can produce it in a matter of seconds with Perkins Precision Spring Coiler. You eliminate arbors, yet turn out precision springs — torsion, compression, extension, tapered, or special springs, coiled either left or right hand, in any desired length, any diameter from 3/32" to 12" and larger, with or without initial tension, and with

open or closed ends. Eliminate expensive special orders and costly production delays! Make your own springs to exact specifications as replacements or experimental work. Make them fast, right in your own shop!



Starrett adjustable jaw cut nippers (left) and Gardener Hook-Kon spring looping tool (center) — handy, precision, time-saving accessories for spring coiling. Perkins Spring Coiler available as bench model or power model shown here, (right) for tool shop or continuous runs.



Special Machinery Division,  
West Springfield, Mass.

**Perkins Machine and Gear Co.**  
Special Machinery Division, Dept. A-2  
W. Springfield, Mass.  
Please send information and prices on  
Perkins Spring Coiler.  
Hand Model  Power Model

Name..... Title.....  
Company.....  
Address.....  
City..... State.....

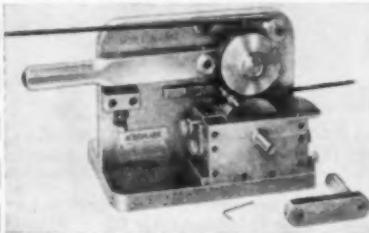
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## INKS and MACHINES for PRODUCT PRINTING...

ACROMARK Chemists have developed many types of liquid and paste inks for product marking on metals, plastics, rubber and other materials.

ACROMARK Printing Machines for many purposes are STANDARD. "Specials" are also made for any application. Automatic, semi-automatic and manual types.



Write for new 1960 Catalog of Inks and Printing Machines.

*The*  
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*Company*

15 Morrell Street, Elizabeth 4, N. J.  
"The Original Marking Specialists"

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294

### Line of Epoxy Resins For Foundry & Tooling Industries

Allaco Foundcast 101, especially formulated for making epoxy molds and patterns, has good machinability, and easy foundry mold release and easy draw. Allaco Sandbind 201 has been produced for making superior molds for casting epoxy duplicates. Combined with Facecoat 301, molds are reported to have greater durability than plaster. Allaco Facecoat 301, designed for use with epoxy molds and patterns, produces high surface smoothness and hardness. All these three compounds are reported to hold close dimensional stability during room temperature cure.

Allaco Multicast 401, formulated for making epoxy jaws and chucks, affords high resilience and impact strength, and cures at room temperature.

Allaco Layup 501 is used to make epoxy molds and patterns with fiber glass layups. Properties include complete resin to glass penetrability, and high rate of application.

In addition, the company has formulated a flouro-carbon dispersed in a liquid vehicle. Surepart, the improved parting agent, has the outstanding property of non-sticking on all types of surfaces.

Allaco Products, 238 Main St., Cambridge 42, Mass.

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### SWISS TESA

The finest in the Dial Indicators.  
Priced from \$20.40 to \$33.00  
Readings in .0001" and .0005".  
Spare parts in stock.

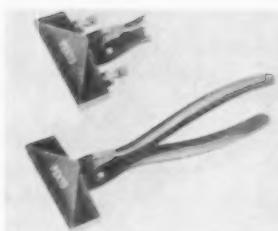
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**SKANDIA TOOL SALES**

3507 E. Olympic Blvd. Los Angeles 23, Cal.  
AN 3-7429



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MACHINE and TOOL BLUE BOOK



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### Two Models of Hand Seamers

The Pexto hand seamer, long a standard tool in the sheet metal and allied industries, is now available in two models.

The No. 793 remains unchanged with conventional Pexto features, including the easy-set gauges for precise and accurate crimping. The new No. 794 model is available without gauges for application on a variety of changing operations, where speed is essential and ease of handling desirable. Both models are sturdily constructed of forged tool steel.

The Peck, Stow & Wilcox Co., 217-34 Center St., Southington, Conn.

# TORIT DUST COLLECTORS

keep plants clean      lessen employee grievances  
save valuable dusts

Torit Dust Collectors keep plants clean . . . an important factor in protecting employee health and morale—and in lowering absenteeism and employee grievances. Economical, too, these units are portable. They cost a fraction of central built-ins and are not limited to certain areas. They save heat by recirculating clean, filtered air. And, as in tungsten carbide manufacturing or diamond grinding operations, they pay for themselves in days with the valuable dusts they recover.



Torit Cabinet Cloth-Filter Model. High efficiency collection of all types of dust. Particles are trapped on fine-woven cloth filters—99%+ efficiency (by weight). Clean filtered air is drawn past the motor and blower to keep it cool.

Self contained, portable steel cabinets. Removable doors allow ready access to filters, motors, and blowers. Filters are chemically treated for spark resistance and sealed against leakage. These compact units give maximum filter area in smallest possible space. Capacities range up to 2100 cubic feet per minute. Larger units are built on special order. Prices start at \$230.

\*For a FREE handbook detailing specifications and performance data of Torit Dust Collectors and applications, write Dept. 629

**TORIT MANUFACTURING CO.**

1133 Rankin Street • St. Paul 16, Minnesota

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## coil stock reels

First—in the automatic production line, a Cooper Weymouth stock reel for smooth, easy unwinding of coil stock to other equipment. In three models, single and double plain and the popular power driven. All models automatically center coils.

WRITE FOR COMPLETE INFORMATION.  
**COOPER WEYMOUTH, INC.**  
607 Honeyspot Road, Stratford, Conn.

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ALSO FOR

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- MACHINE KEYS

STANDARD TAPER PINS are milled from carefully selected bar stock for extremely close tolerances . . . straight to taper. The uniformity and accuracy of STANDARD TAPER PINS will save time on assembly . . . will assure you of trouble-free service. Available in STANDARD steel . . . also in stainless steel and brass. Specify STANDARD TAPER PINS and other STANDARD products.

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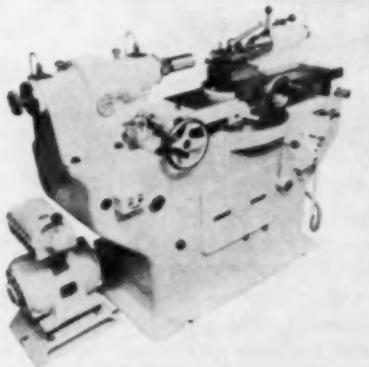
**STANDARD STEEL SPECIALTY CO.**  
BEAVER FALLS • PENNSYLVANIA

Plants: Beaver Falls, Pa.; Hammond, Ind.

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## Precision Diamond Tool Lathe Has New Variable Speed Drive

The Bryant Symons lathe features an infinitely variable speed drive giving spindle speed selection from 250 to 2250 rpm. Dimensional accuracy, surface flatness, and correctness of cylinder form are reported, due to special design features. The lathe has been designed primarily for machining metal



components with the use of diamond tools, but ceramic and carbide may also be used.

The variable speed driving unit is mounted separately to prevent transmission of vibration to the machine.

Two sizes are offered, 8" and 13 1/4"; distance between centers is up to 28 1/4"; automatic feeds, .001" to .005" per revolution.

Milo Manufacturing Co., 259 N. Broad St., Elizabeth N.J.

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## DRILL FEED UNITS



for drilling, tapping, milling, boring. Cam, hydraulic, or lead screw. Many sizes, 1/2 to 15 hp. Avey Division, Mott & Merryweather Machinery Co.

Avey

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MACHINE and TOOL BLUE BOOK

## High Speed Tapping Attachment For Punch & Multi-Slide Presses

A self-powered unit is reported capable of tapping more than 6,000 holes per hour—depending on the size and depth of hole. It can be mounted for either vertical or horizontal operation. The stroke of ram or cam of press actuates tap movement into hole, while interlocks stop the press if the tap fails to clear the hole.

Tap range is up to 5/16" dia. Average speed of the tapping attachment is 1750

rpm and withdrawal is 3500 rpm. Reversal at end of stroke and resetting to forward rotation is instantaneous.

The attachment can be used in conjunction with other automated machines or it can be used separately for subsequent tapping operations.

Standard stock units are available for multi slide presses. Dies for punch presses in most cases have to be redesigned to incorporate tapping unit.

Smith Mfg. Co., 208 St. Clair Avenue, N.W., Cleveland 13, Ohio.

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DO YOU  
THROW  
"USED" TAPS  
AWAY?

**STOP**

*You can't afford it!*

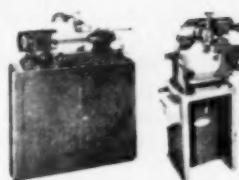
As the pictures show, taps cost roughly 6 times as much as drills. Yet it's common practice to resharpen the drill — and throw away the tap.

It doesn't make sense. And it's an awful waste of money.

That's where Blake comes in.

Blake makes low cost, high-precision tap grinding equipment. These easy operating tools can make your taps last up to 6 times longer . . . reduce work spoilage . . . enable taps to cut more accurately and uniformly with less strain . . . cut tap costs as much as 65%.

It's surprising how many people overlook this proven, basic method of saving money. Be sure you don't. Ask us for complete information.



**Blake Chamfer Grinder/Blake Flute Grinder**  
used in combination, create or restore:  
1. exact indexing of cutting edges.  
2. controlled rake angles for each job.  
3. correctly ground spiral points.  
4. perfectly relieved chamfers . . .  
make one tap do work of six!

EDWARD **BLAKE** COMPANY, INC., WATERTOWN, MASSACHUSETTS WA 6-0100

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October, 1960

297



# BREAKTHROUGH! LOW COST ZIPPER BAG

- Dustproof
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Imprinted to your Requirements

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- Parts or Tools
- Job Tickets
- Various Forms



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Seal with finger pressure — Open with thumbnail

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20th century plastics, inc.

(Formerly known as Perfor Plastic)

415 EAST WASHINGTON BLVD. LOS ANGELES 15, CALIF.  
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save 20 to 30% on new  
**CARBIDE TOOLS**

RICO has a complete line of:

- Quality rotary carbide & HSS tools
- Available for immediate delivery
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- Special tools to specifications
- Distributor inquiries invited about better profit margins with RICO TOOLS.

Attach ad to your letterhead for more information.



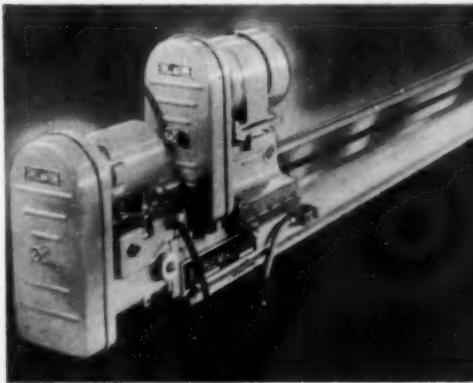
RICO TOOL CO.

5915 DIXIE HWY. • SAGINAW, MICH.

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## 60" Holes Gun-Drilled With Standard Power Units

The Borematron Sixty, a new heavy duty gun-drilling and boring power unit, was designed to gun-drill extremely long holes, ranging up to 60" in length and 3" in diameter. These holes can be gun-drilled from the solid, in one pass, on a production schedule. The ability of the machine to consistently produce high quality holes eliminates such operations as pilot drilling, reaming, and honing. This precision machining is achieved by



using a combination of high spindle speeds synchronized to an extremely fine feed rate.

Infinitely variable feed rates are obtained by a positive drive mechanical transmission. Once the feed is set, it will not vary or surge, even when drilling through hard or soft spots, or other intersecting holes. The variable

## CAM MILLING

Fully equipped modern machine shop with extensive Jig Boring, Surface Grinding, Horizontal Boring, and Thread Grinding facilities as well as modern Cam Milling and Cam Grinding equipment.

*Your Inquiries Answered Promptly*

**HIMOFF MACHINE CO., INC.**

23-22 44th Road Long Island City 1, N.Y.

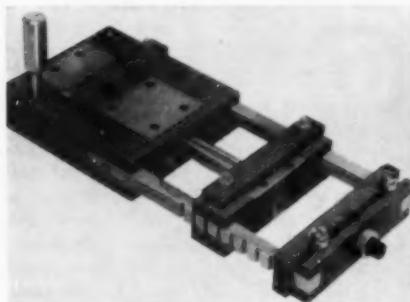
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MACHINE and TOOL BLUE BOOK

feed rate is adjustable from a minimum of .0001 per revolution to a maximum of 30" per minute. Spindle speeds are variable up to 10,000 rpm, and can be matched to any feed rate, thus allowing for the difference in workpiece material and the finish required.

Drillmation Co., 6500 E. 11 Mile Rd., Center Line, Mich.

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#### Punch Press Feeds

Mechanical Tool & Engineering Co. announces two new Rapid-Air punch press feeds—air-operated models D-5 and F-6. Model D-5 feeds stock up to 4" wide with a 0" to 5" stroke; Model F-6 feeds stock up to 6" wide with a 0" to 6" stroke. Accuracy is reported as held within  $\pm .001$  without using pilots. Both feed rate and stroke length are adjustable. These versatile feeds can be mounted on die-set or bolster plate and can feed automatically from either side, front or back.

The compact punch press feeds are

#### DRESS CENTERS FAST—ECONOMICALLY WITH ABRASIVE CENT-R-LAP TOOL



Eliminates time and dust of diamond dressing • Removes scale • Laps without chatter. Sold in three sizes direct to consumer. Send for literature and prices.

**J. R. REICH MFG. CO.**  
P.O. BOX 2152 DAYTON 29, OHIO

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October, 1960

*Hammond*  
OF KALAMAZOO

#### 6" Wet-N-Dri Abrasive Belt Grinder

#### For FLAT SURFACING

- Castings
- forgings
- Plastics

Vertical or  
Horizontal  
Operation

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1614 Douglas Ave., Kalamazoo, Michigan

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**FOR  
PRECISION STRIKING  
SEND FOR THIS FREE  
INFORMATIVE  
GARLAND  
BROCHURE**



- Split-Head Hammer with interchangeable nylon or rawhide faces.
- Solid Head Rawhide Hammers
- Solid Rawhide Mallets

**GARLAND MANUFACTURING CO.**

70 Water St., Saco, Maine

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299

If you EVER cut  
 Keyways . . . you should  
 NEVER be without a  
 Minute Man  
**KEYWAY BROACH  
 KIT**



With one, you can cut a keyway in one minute for as little as one cent by hand with an arbor press. Twenty different kits available from stock for keyways from  $1/16$ " to  $1$ " in any bore from  $1/8$ " to  $3$ ".

*Save Time With*  
**STANDARD STOCK  
 SQUARE BROACHES**

Starting with a round pilot you can finish an accurate square hole in one pass in less than one minute. Hexagon and round broaches also available.

**The duMont Corp., Greenfield, Mass.**

MAIL FREE BROACH CATALOG AND PRICE LIST T describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name . . .

Company . . .

Address . . .

duMONT

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300

said to assure high speed feeding, easier set-ups, positive stock clamping, and precision operation.

Four other Rapid-Air models are available. Model A-2 feeds stock up to  $1\frac{1}{2}$ " wide with a 0" to 2" stroke. Model A-4 feeds stock to  $1\frac{1}{2}$ " wide with a 0" to 4" stroke. Model B-3 feeds stock to  $2\frac{1}{2}$ " wide with a 0" to 3" stroke. Model C-3 feeds stock to 3" wide with a 0" to 3" stroke.

Mechanical Tool & Engineering Co., 2323 23rd Ave., Rockford, Ill.

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**Improved Automatic  
 Counting Device**

Pneumaticount is designed to provide accurate, automatic counting of any operation controlled by pneumatic or hydraulic action. The unit screws into the line controlling any air or hydraulic cylinder. There are no linkages to assemble, no solenoids, and no possibility of half or miscounts. Models are available for from one to 5,000 lb. and up to 300 counts per minute. All models are available with five or six digits, .166 high, white or black.

Pneumaticount, Inc., 3400 N.E. 54th Ave., Portland 13, Ore.

Use postpaid card. Circle No. 199

**Die Cut Stampings**

The Dayton Rogers Manufacturing Co., Minneapolis 7, Minn., now has for free distribution engineering educational display boards measuring 24 x 36 with representative die produced precision stampings mounted thereon, with tabulated cross references num-

**JIG GRINDING  
 and JIG BORING  
 to your specification**

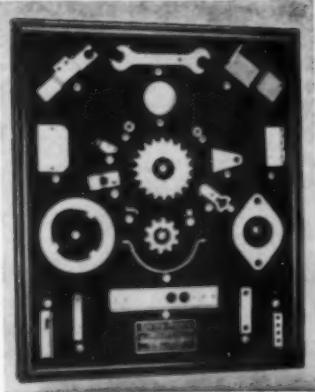
At your disposal: Our sub-contract jig boring department, one of the best equipped in the East.

**A. K. TOOL CO., INC.**

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 Telephone: ADams 2-7300 Dilby 9-1445, N. Y. C.

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MACHINE and TOOL BLUE BOOK



bered and lettered and full engineering detail as to over-all costs and general specifications of the given piece parts made in various sheet alloys and other non-ferrous materials.

These boards are particularly advantageous for engineering and drafting rooms where pilot runs or short run stampings are to be considered before the release of conventional tooling. They may be had when requested on company letterhead.

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NEW IMPROVED  
*Airflex*  
PNEUMATIC  
RIVETERS  
with rotating impact!



#### SAFER PRECISION RIVETING on All Types of Materials

- ★ Controllable impact eliminates bent rivets, loose joints, flaking metal, broken work pieces, etc.
- ★ Strikes as it spins—subjects only small cross-section of rivet head to force of blow.
- ★ Engineered for precision adjustment to fit the job. Fully tested.
- ★ Choice of models—interchangeable hammer units and peens—in rivet sizes from  $1/16"$  to 1". Thousands in use.

Send for bulletin with complete listing.

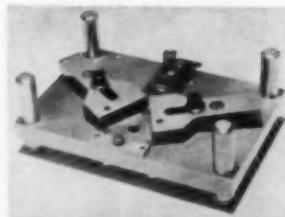
**LEMERT ENGINEERING CO., INC.**

Factory: 203 E. Jefferson St., Plymouth, Indiana, U.S.A.

Use postpaid card. Circle No. 412

## **Stainless Steel Precision Tool Components**

PIC Design Corp., a subsidiary of Benrus Watch Co., Inc., now features an expanded line of stainless steel tool components for use in all precision machine jig, test fixture, and tool design applications. This co-ordinated line of individual parts and complete assemblies includes clamps, dogs, studs, spacers, washers, jig buttons, legs, heel pins, springs, and precision ground plates in a wide range of types and sizes. Round, square, or rectangular precision ground jig plates, in stainless steel or aluminum, are ground to a 32 microinch finish all over, with surfaces flat and parallel within a  $\pm 0.0005$  tolerance.



**PIC Design Corp., 477 Atlantic Ave., East Rockaway, L.I.**

Use postpaid card. Circle No. 150

## **Double Carbide Special Alloy Band Saw Blade**

A new double carbide special alloy band saw blade, manufactured especially for standard cut-off band saw machines, is said to cut 50% faster than carbon bands and enables standard band saw machines to operate at close to maximum efficiency. It is also stated that the new band cuts a wider range



of metals, including the tougher alloy steels, and results in greater blade life with reduced downtime for blade changing.

Other advantages reported for the Starrett Alloy Band include improved hot hardness and abrasion resistance which permits using higher and heavier speeds on standard band saw machines.

**The L. S. Starrett Co., Athol, Mass.**

Use postpaid card. Circle No. 151

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—USE THE BEST...**

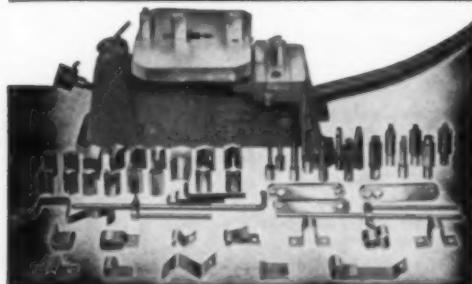
**GRAYMILLS  
MIST COOLANT  
SYSTEMS**



Superbly engineered units of rugged corrosion-proof construction. Dual or single outlets. Precise liquid and air controls. Translucent containers let you see the liquid level. 1 and 2 1/2 gal. sizes for water, coolants or oil.

Write today

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**Multiform** **BENDER  
CUTTER**

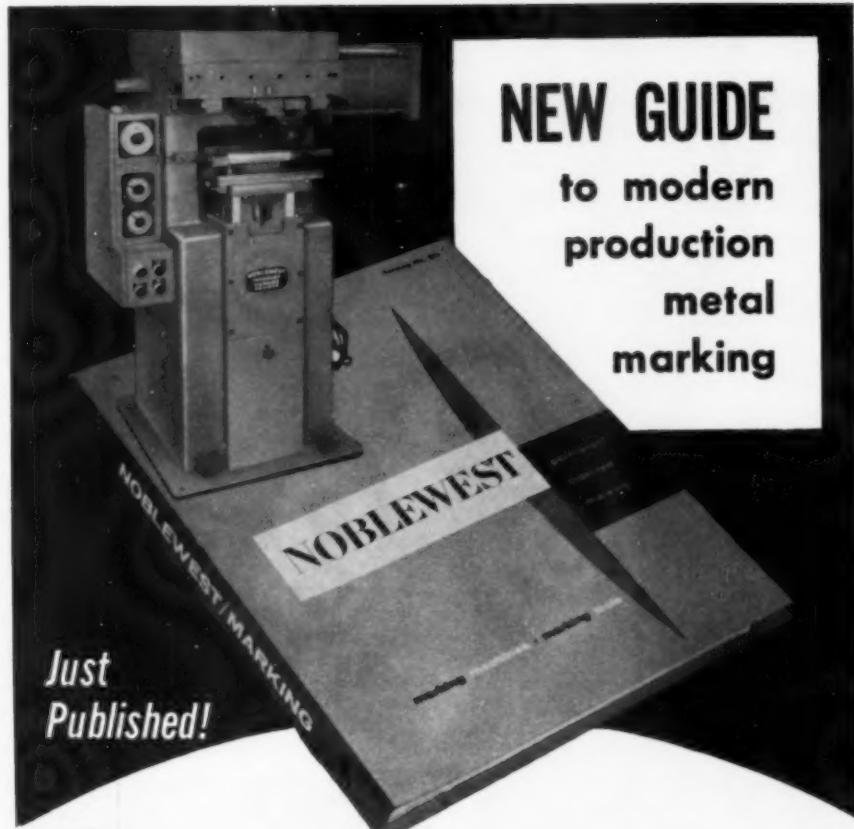
**CUTS, BENDS, PUNCHES**

Available in hand, air and hydraulic models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to punch, bend and cut round or flat brass, bronze, aluminum, steel, etc., up to  $1/8" \times 1\frac{1}{2}"$  as illustrated, other models up to  $1/2" \times 8"$ .

**J. A. RICHARDS CO.  
KALAMAZOO, MICH.**

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MACHINE and TOOL BLUE BOOK



To mark what you make . . . to mark it well . . . to mark it **permanently** is essential to modern manufacturing and marketing. To **mark it best with Noblewest** has become a tradition with leaders throughout the industry, for Noblewest marking is **permanently indented** marking . . . and Noblewest equipment marks faster, better, at lower cost. Our new catalog is a most comprehensive guide to the selection of marking machines and marking tools. For a copy write Noble & Westbrook Manufacturing Company, 9 Westbrook Street, East Hartford 8, Conn.

**MARK IT BEST WITH**

**NOBLEWEST**

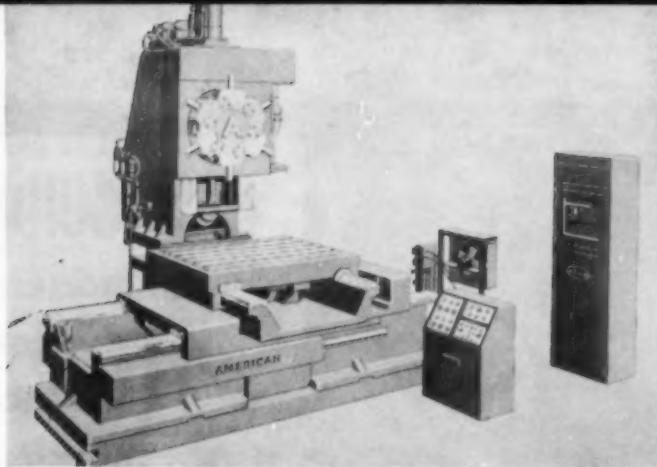
NOBLEWEST IMPROVED MARKING DEVICES

MARKING  
NUMBERING  
EMBOSSING  
GRADUATING

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October, 1960

303



Positioning table moves 30" x 20", and positions to  $\pm .00025"$ .

### Machine Positions, Performs 5 Operations Automatically

Offering wide flexibility, the American six-spindle Model AA-Turretex drills, taps, reams, counterbores, and faces automatically. It is stated the two-axis, ultra-precision positioning table moves 30" x 20" and positions to  $\pm .00025"$ .

Pre-selected speeds, feeds and tapping cycle for any or all the six spindles, and positive stops with dwell for accurate facing and counterboring, are out-

standing features.

Spindles are heavy-duty alloy steel with taper roller bearings, and are available with straight bore for No. 3 Morse Taper ASA adjustable adapter assembly, or flanged nose for stub nose collet chucking tool for light milling operations.

The American Tool Works, Pearl at Eggleston Ave., Cincinnati 2, Ohio.

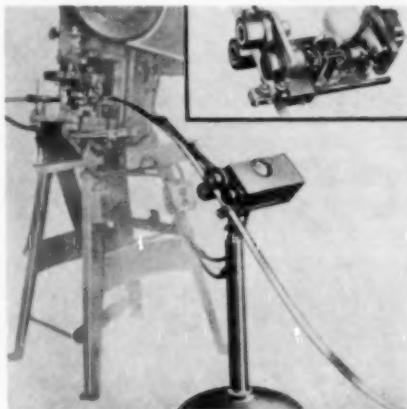
Use postpaid card. Circle No. 107

### Positive Mechanical Action Machine Stop

Feed-Off, a completely mechanical, production-proven machine stop, is designed for use on punch presses and other types of machinery.

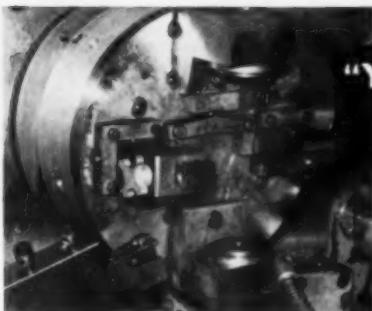
Rugged and dependable, this portable device is designed to instantly stop a machine, if length of stock per stroke drops below a preset minimum, if stock varies in thickness, if defects such as burrs and tears occur in stock, and when stock coil end approaches. Stop action increases die life, saves down time and will allow more machines to be run at a higher rate of speed with fewer operators in attendance.

Rands Products, Inc., Dept 4K, Willimantic, Conn.



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# Orbit Valve, Tulsa, proves it again:



"You make money every time  
you chuck with *Buck*."



Shows clever, equalizing fixtures and top jaws developed by Orbit which work in conjunction with the 2 jaws of the Buck power chuck.

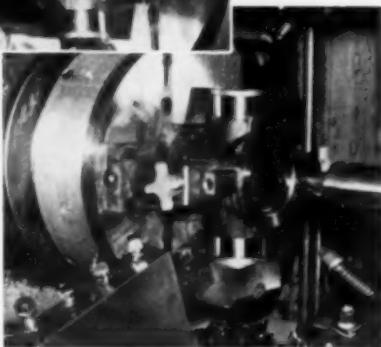
Operator places valve in position for machining. →  
Lathe is a 3 AC Warner & Swasey Automatic.

Final operating step: finish reaming. Four other operations include — rough face of valve body flange, rough drill, and rough bore; rough drill trunnion diameter, rough out bonnet diameter; cut core clearance, finish bonnet diameter; finish trunnion diameter and bottom of trunnion. Trunnion tolerances and concentricity must be within .003".

The continual plant modernization program of Orbit Valve Co., Tulsa, Oklahoma — pioneer producer of valves for handling petroleum and petrochemicals — resulted recently in saving 18 hours a week on valve body production.

The major change was from hand turret lathe operation to automatics, using the Buck Aluminum body power chuck. It could be done because of the Buck precision capabilities.

Future expected improvements are a 10% increase in production, major time-



savings on a former true-up operation, and consistent quality that will reduce inspection time.

The Buck Ajust-Tru® principle guarantees precision within ".001" on automatics, and provides many other distinct advantages. Send for a catalog. See why "It pays to chuck with Buck."

Makers of Scroll, Power,  
Dust Proof, Independent  
Chucks.

**BUCK TOOL COMPANY**

1012 SCHIPPERS LANE • KALAMAZOO, MICH.

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ELECTRIC  
HEAT TREATING  
FURNACES

41 Models—with and without

*Controlled Atmosphere*

**RECIRCULATING  
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for drying, baking, etc. 3 Types—  
650° F., 850° F., and 1000° F. Wide  
range of sizes.



**INDUSTRIAL BOX  
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for general heat treating to 2000° F.  
Highly efficient with low maintenance; quick repair with small down time; sturdy; reliable.



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- New GA Atmosphere Box Furnace
- Recirculating Air Draw
- Bench Types
- 2500° F Box Furnace

# Cooley

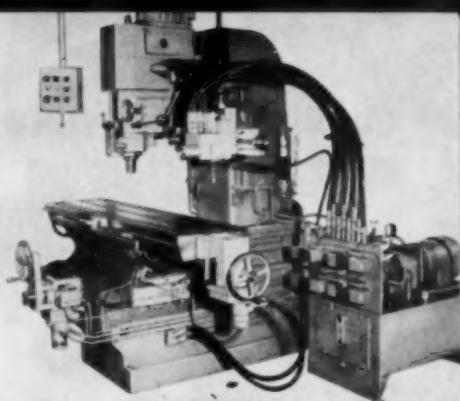
ELECTRIC MFG. CORP.

36 S. SHELBY ST.

INDIANAPOLIS 7, INDIANA

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306



**Milling Machine With  
Duplicating Controls**

Visi-Trol Model 3-1/2 vertical milling machine, with three dimension hydraulic duplicating controls, is said to be convertible from duplicating to conventional milling in one minute.

The milling head, run by a 5 hp 1200 rpm motor, has 22" throat clearance. Vertical feed is infinitely adjustable. Vertical travel is 16". There is power or hand feed.

The 16" x 66" table makes use of tracer feed and manual rapid feed control. Longitudinal travel is 36"; traverse, 16".

Vertical travel of spindle is 6"; with vertical feeds of .015", .006", and .003" per revolution. Spindle speeds 68 to 2400 (eight selections) are changed by selector lever.

Visi-Trol Engineering Co., 12720 Burt Rd., Detroit 23, Mich.

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**BREMIL**  
The IMPROVED Compound Lever Shears

ALL ALLOY  
FULLY  
GUARANTEED



Two Sizes

PORTABLE

No. 1 cuts up to No. 11 gauge strip or sheet.  
No. 2 cuts up to  $\frac{1}{4}$ " steel plate.

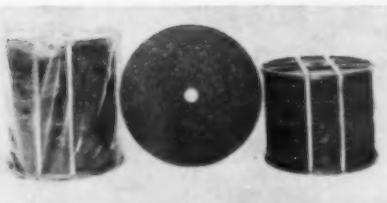
**BREMIL MFG. CO.**  
1020 Holland Street, Erie, Penna.

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MACHINE and TOOL BLUE BOOK

### Metal Cutting Discs

A new aluminous oxide resin bonded abrasive disc, designed for metal cutting, is available in 7" and 9 $\frac{1}{8}$ " diameters in a choice of five standard grains. The new RD fibre backed discs feature a pressurized 100-unit package with complete 360° protection by metal straps. An outer pliofilm bag protects the disc package. One 100-unit package of No. 60 grain "RD" discs sells for under \$30.



Chicago Wheel & Mfg. Co., 1101 West Monroe St., Chicago 7, Ill.

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THE Finest  
IN GEARS  
**Beaver Gear Works Inc.**  
1033 PARMELE STREET, ROCKFORD, ILLINOIS

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### ANNOUNCING NEW SixPac KITS OF NIAGARA CARBIDE FACE MILLS

Six carbide tip face mills with  $\frac{3}{4}$ " integral shanks paired in 1 $\frac{1}{2}$ ", 2" and 2 $\frac{1}{2}$ " size. Cabinet with cushion liner combines convenience and protection. Paired sizes provide spares to cut down-time. Satisfaction **\$115** With Cabinet guaranteed. Ask for Catalog 6-PK-566

Also Mfrs. of Standard, Special and Modified Tools.

**NIAGARA CUTTER**

Division of Bollier-Damerell, Inc.

**336 Niagara St., N. Tonawanda, N. Y.**

Use postpaid card. Circle No. 446

October, 1960

307

### RIVETERS . . .

**GRANT**

PIONEERS  
and  
PACEMAKERS  
in their line



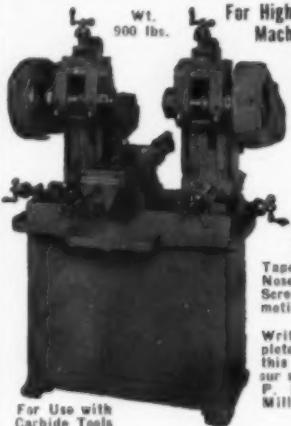
head rivets from smallest to  $\frac{3}{8}$ " diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—sizes to meet all needs—types include Vertical and Horizontal Multiple Spindle.

Write for literature and don't forget to send samples

**THE GRANT MFG. & MACHINE CO.**  
CE Station Bridgeport 5, Conn.

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**BARKER****DUAL-HEAD MILLING MACHINE**Wt.  
900 lbs.

For High Production  
Machining of  
Two  
Surfaces  
At Once  
MODEL  
A.M.D.

Complete  
with Pedes-  
tals, Two  
3/4 H.P. Mo-  
tors, No. 30  
Taper in Spindle  
Nose. Micro Feed  
Screws on all  
motions (Extra).

Write for com-  
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this mill and  
our smaller model  
P. M. D. Dual  
Mill.

For Use with  
Carbide Tools**BARKER ENGINEERING CO.**

Division, The F. Hohlfelder Co.

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Cleveland 32, O.

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You can count on Tamms qual-  
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308

**Centricator**

will solve intricate truing  
problems on Jig Borers, Milling  
Machines and Toolroom  
applications.

more accurately —  
more speedily —  
and economically



because DIAL GAGE  
does NOT revolve with  
tracer.

Fully Universal in  
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Optional reading in  
.0005" or .0001".

Request detailed literature.

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BORING HEADS**

## UNPARALLELED

- ACCURACY
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REPEAT TO .0001"  
IN 30 SECONDS  
WITHOUT BACKLASH  
CAN BE ADAPTED  
TO FIT ANY  
MACHINE

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MTBB-100

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MACHINE and TOOL BLUE BOOK

### Compact Tapping & Threading Tools

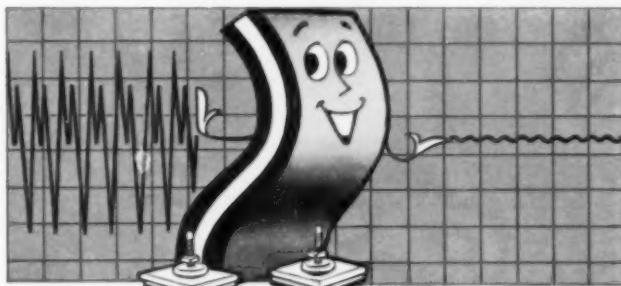
A new line of compact tapping and threading tools is designed to eliminate the necessity of employing lead screws or sensitive hydraulic and mechanical feeds on automatic screw machines, multiple spindle drilling machines, and turret lathes. These new tools have wide capacity ranges and relatively small diameters. The No. 10-1/2" capacity tool, for example, has a body with a maximum O.D. of only 1". Use of rubber-flex collets permits wide tap capacity of each tool. Features axial floating drive spindle and positive depth control.

Tapmatic Corp., 845 W. 16th, Costa Mesa, Calif.



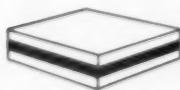
Features axial floating drive spindle and positive depth control.

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## IS VIBRATION ROBBING YOU BLIND?

Unisorb® machine mounts—either pads or Level-Rite devices—reduce up to 85% of transmitted vibration and provide a practical, low-cost solution to almost all vibration problems. Unisorb Vibration Control reduces noise, worker fatigue and human inefficiency. Unisorb will reduce maintenance of buildings and machines, cut down-time and simplify machine installation. In addition, tests show that Unisorb permits running machines at higher speeds and closer tolerances for increased production and improved quality.



Unisorb  
Mounting Pads



Unisorb  
Level-Rite 200



Unisorb  
Level-Rite Mount

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Division of The Felters Co.  
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Plain Type

TRADE

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MARK

Offset Type

## CONTINUOUS HINGES

All hinges shown can be furnished with special holes, cutouts and bends to blue-print in metals to suit the job.

THREE-FOURTHS  
OFFSET

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### SPECIFICATIONS

Open width  $7/8$ " to 6"  
Gage Material .040 to .187"  
Pin Diameter .093" to  $1/2$ "  
Lengths to 120"

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### Counterbore Cuts Forward or Backward

The new Multi-Tool counterbore is adaptable to unlimited counterboring and spotfacing applications, with a greater tool economy and better tool control reported with the interchangeable feature.

Multi-Tool blades have spooned cutting edges that cut clean precision holes and eject chips properly. Practically

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### STANDARD FIXTURE CLAMPS AND DETAILS

#### Save Tool Room Time!

Precision-machined, hardened, rust-proofed. Fast delivery from stock! Cut design time, increase tool room production and save many man-hours by specifying STANDARD HARCO FIXTURE CLAMPS AND DETAILS.

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all materials can be machined—hard or soft. The blades are easily modified for a variety of multiple one pass cuts such as counterboring with a shoulder cut—chamfer—radius—"O" ring or many other variations. When reverse or back



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### Stops Losses

making Dies and  
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Popular package  
8-oz. can fitted  
with Bakelite cap  
holding soft-hair  
brush for applying right  
at bench; metal surface  
ready for layout in a few minutes.  
The dark blue background  
makes the scribed lines show up in  
sharp relief, prevents metal glaze.  
Increases efficiency and accuracy.

Write for sample on company letterhead  
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2301G North 11th St. • St. Louis 6, Mo.

MACHINE and TOOL BLUE BOOK

counterboring, reverse ground blades are used. Heavy duty series only is recommended for this application.

The tool is ideal for machining out larger diameter holes.

Medium duty set ranges from No. 10 to  $\frac{3}{4}$ " cap screw size. The set consists of seven pilots and ten blades (H.S.S.) which accommodate the regular and the '60 series cap screw sizes. Heavy duty series ranges upwards from  $\frac{1}{2}$ " pilot diameter—blade sizes to cus-

tomer specifications—H.S.S. or carbide.

Multi-Tool Co., 14512 Burt Road, Detroit 23, Mich.

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#### Miniature Band Saw Guides

A new line of miniature band saw guides has been designed for use on 14", 16", 18" and 20" machines, or for light and medium work on larger machines. These Guidall, Jr. guides feature ball bearing support and thrust



For Approximately \$50 You Get 12 Sets, Each Set Ground Ready To Go

## Men would not accept EITHER IDEA AT FIRST

### INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For approximately \$50 you get a dozen sets of  $\frac{3}{4}$ —16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime. FREE: "Unified and American Screw Thread Digest"

**EASTERN MACHINE SCREW CORPORATION**  
**25-45 Barclay Street, New Haven, Conn.**

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ANOTHER PANNIER MASTER MARKER!



New Roto-Pin type lock is integral part of all Pannier Supreme Holders . . . eliminates loose, bent, dropped, or lost pins . . . flip it open to change type . . . flip it back to securely lock type in clear-marking position.

Write for complete data.

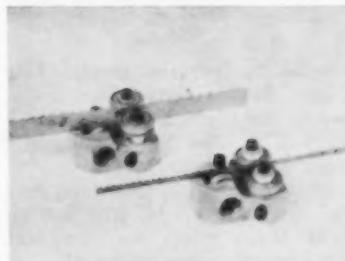


MARKING DEVICES  
THE PANNIER CORPORATION

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Offices: Los Angeles • Chicago • Cleveland • Philadelphia • Birmingham

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PANNIER'S  
SUPREME HOLDER  
WITH ROTO-PIN LOCK

Safe, fast type changing. Holder in variety of styles. Machine Pins, High Carbon Steel. Hardened and maintains type alignment. Striking Head of Tool Steel. Replaces pins to add long service life to Holder.

rollers specially constructed and sealed for accurate performance and long life under maximum load conditions. An eccentric adjusting device permits ready adjustment to handle any blade from  $\frac{1}{8}$ " to  $\frac{3}{4}$ " in width at speeds up to 8000 fpm and thrust loads up to 50 lbs. in complete absence of friction, it is reported. Models are available with mounting brackets.

Carter Products Co., Inc., Helmer Bldg., Grand Rapids, Mich.

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# Connecticut

## QUALITY-SIMPLICITY

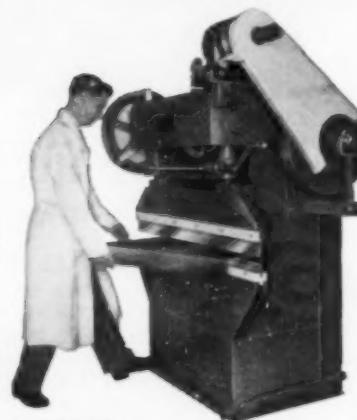
### Reasonably Priced

For Continuous Production, Experimental Work, or to Relieve Larger Brakes of Small Jobs.

**FEATURING**—Precision Front—Operated Back Gage and Variable Speed Drive.

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### 24 TON PRESS BRAKES



48" and 78"  
bed lengths

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MACHINE and TOOL BLUE BOOK



Write for  
Production Tool Catalog.

## MULTI-DRILL makes holes at a PROFIT!

This Model 600 MULTI-DRILL—an adjustable multiple spindle drill press attachment—fitted with optional Guide Rods, is drilling two 1/2" holes in a work piece at every stroke of the drill press—and is reducing hole costs to the basic minimum. The same unit is used on three other set-ups to drill holes ranging from 3/32" dia. to 5/8". Quickly adjustable spindles and heavy duty construction make this MULTI-DRILL a versatile time and money saving production tool that pays for itself many times over. Ask your nearby Commander Distributor to show you how a MULTI-DRILL can help solve your multiple spindle drilling problems. There's a model and size for any application or drill press.



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Conant offers complete engineering and manufacturing facilities for your broaching needs. Expertly designed for proper strength and chip carrying capacity. Prompt broach sharpening and reconditioning service. Order standard keyway broaches from our stock.

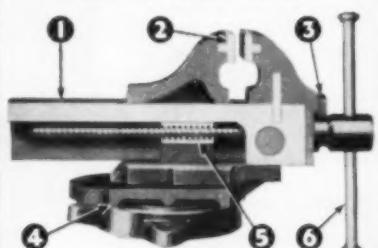
Your inquiry invited. Send us part prints for recommendation and quotation.

**BROACH COMPANY**  
13747 S. Western Ave., Blue Island (Chicago Suburb) Ill.

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# VISE FEATURES

1. exclusive steel slide milled from solid bar
2. replaceable jaw inserts held by top-entering pins
3. outside screw retainer



4. positive locking 360° swivel base
5. longest wearing alloy steel nut
6. one-piece non-pinch handle

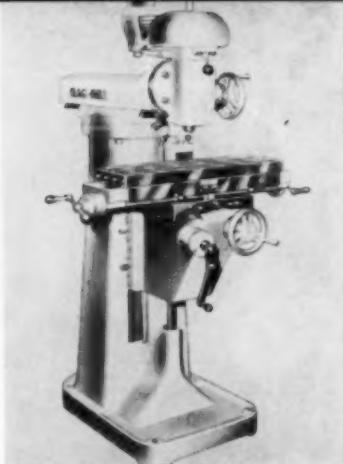
## SOLID STEEL SLIDE

Simplex industrial vises give you the advantage of solid steel slides, jaws, nuts for maximum strength and ruggedness long after their modest cost is written off. Line includes milling machine, pipe, sheet metal and other models.

## Desmond Simplex

The Desmond-Stephan Mfg. Co.  
Urbana, Ohio

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### Vertical Milling Machine Features Magnetic Table

The need for time-consuming bolting and clamping to hold the work-piece is eliminated by the built-in electro-magnetic table of the new Mag-Mill vertical milling machine. A built-in manual reversing switch which demagnetizes the table, work-piece, and accumulated chips, makes it easy to remove the work and keep the table clean. Automatic demagnetizing is also available.

The table has 7"x27" working surface; longitudinal table travel is 16"; cross travel, 8"; vertical knee travel, 15"; vertical quill travel, 4".

Distance from spindle nose to top of table is 16-5/16". With compound head swivel, the distance is 16-9/16".

Hanchett Magna-Lock Corp., Dept. BB7, Big Rapids, Mich.

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*apply layout blue easier...*

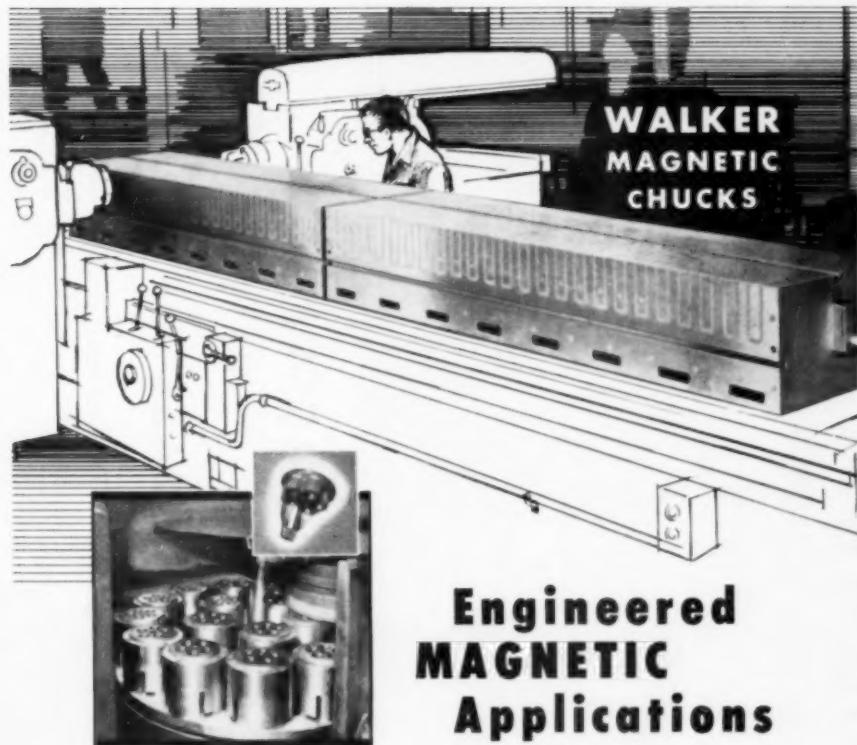
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APPLY AND STORE LAYOUT BLUE EASIER. USE ELLISCO BRUSH TOP CANS. BRUSH STAYS MOIST, CONTENTS WON'T DRY OUT. 3 OZ. TO 1 QT. CAPACITIES. WRITE TODAY FOR DETAILS, FREE BULLETIN.

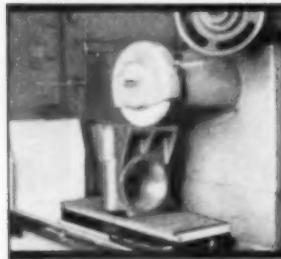
George D. Ellis & Sons, Inc.  
4024 N. American Street, Philadelphia 40, Penna.

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#### SPECIAL ROTARY

A special rotary auxiliary plate with cylindrical magnetic raising blocks holds irregularly shaped parts of grinding with quick easy set ups.



#### CERAMAX PERMANENT

A rugged Walker "Ceramax" chuck with ultra permanent ceramic magnets holds a large part for precision grinding.

## Engineered MAGNETIC Applications

Walker engineers are continuously solving new holding problems for industry. The three-faced electromagnetic chuck above is only one example of the special designs created by Walker ingenuity and "knowhow". Whether you need any one of the complete line of standard magnetic chucks or a specially designed item, your best source is Walker.

*O.S. Walker* Co., Inc.

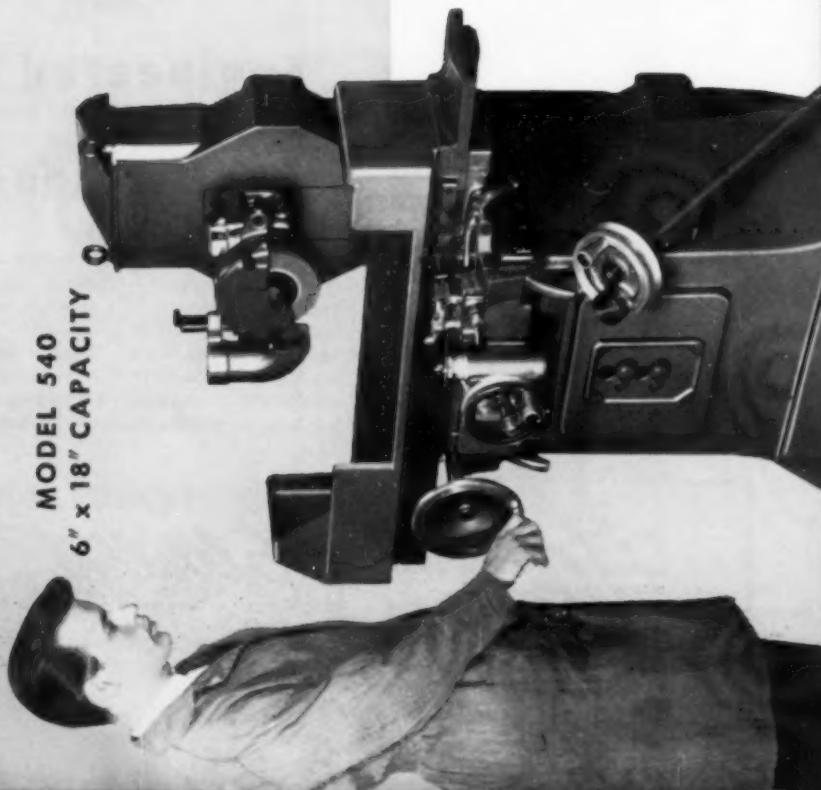
ROCKDALE ST. • WORCESTER 6, MASS.  
*Original Designers and Builders of Magnetic Chucks*

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# HYDRAULIC SURFACE GRINDER



MODEL 540  
6" x 18" CAPACITY



ACCURACY . . .

EFFICIENCY . . .

EASE OF OPERATION

This machine has all the essential qualities required to provide high caliber surface grinding. Its simplicity of design provides ease of operation while inherent accuracy and efficiency assure excellent grinding performance. Thousands of

## FEATURES:

- Completely centralized controls within easy reach of operator.
- Patented low-pressure, long-life Hydraulic System operating from self-contained motor-driven pump unit.
- Table traverse rates variable from 5' to 40' per minute.
- Smooth and shockless reversing at maximum speeds.
- Cross-feed automatically variable from .01 in. to .07 in. per stroke.
- Hand controls provided for both traverse and cross-feed. Micrometer adjustment to cross-feed in .0001 in. divisions.
- Vertical adjustment of wheelhead controlled by conveniently placed handwheel having a micrometer knob adjustment in .0001 in. divisions.
- Wheelhead slide operates on ball bearing rollers running on precision ground bars providing absolute sensitivity of vertical feed.

Automatic vertical wheelhead feed and electric lift can be fitted to standard machine as an extra feature. Also, numerous other attachments including form tool grinding equipment are available to assure full versatility.

**FOR FURTHER INFORMATION, WRITE FOR YOUR COPY OF BULLETIN C183.**

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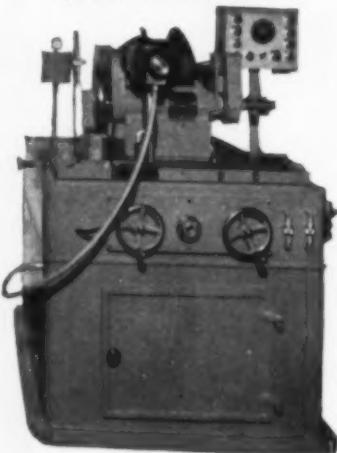


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**CARBIDE  
DISPOSABLE  
TOOL & PUNCH  
GRINDER**  
(Semi-Automatic)



**GRINDS ANY SHAPE OR RADIUS**

Holds sides and radius perfect tangent. Will hold .0005 tolerance. Will grind negative or positive angle tools or punches. One operator can easily operate three machines. Will regrind your used blanks at a small fraction of their original cost.

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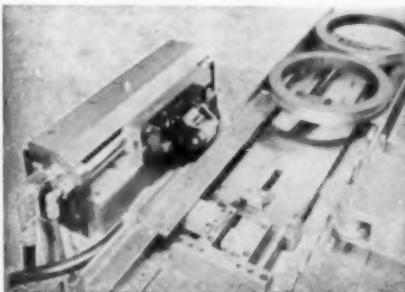
**HARVILL-JOHNSON CORP.**  
618 EAST TEN-MILE ROAD  
HAZEL PARK, MICH. PH. Jordan 4-6110

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318

**Correction!**

We inadvertently reversed captions for the Geo. T. Schmidt, Inc. machines—the GTS Pneumatic bench press and the Model 465 GTS hydraulic marking machine—in the September issue, pages 257 and 258. Correction is made below.



Automatic shuttle feed and serial numbering head is equipment of Geo. T. Schmidt marker.



Geo. T. Schmidt unit is equipped with vibrating hopper and shuttle feed for marking small parts.



**DRILL THESE HOLES**  
BY A QUICK, EASY, INEXPENSIVE METHOD  
Your business letterhead will bring literature  
WATTS BROS. TOOL WORKS  
Wilmerding, Pa.

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MACHINE and TOOL BLUE BOOK

## HUPPERT

### Floor Model Furnaces

Built in 28 Standard Sizes

- Continuous operation to 1850° F.—intermittent to 1950° F.—for 2300° F. on special order.
- Complete with indicating electronic controller.
- Tight-sealing, wedge-type door.
- Standard for 220 V. AC, single or 3 phase operation—110 V. or 440 V. on special order.
- Multi-insulation for maximum efficiency.

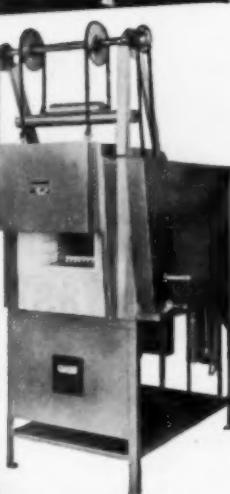
Request literature  
on complete line of Huppert Furnaces

#### Model No. 16 Illustrated

**K. H. HUPPERT CO.**

Manufacturers of Electric Furnaces and Ovens

6845 Cottage Grove Ave., Chicago 37, Illinois



Inside Dimensions  
12" W. x 8" H. x 18" D.  
\$1050.00 complete

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## ELLIS DIVIDING HEADS...



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• TOOLS

### BUILT FOR THE MOST CRITICAL

Whether the need is for extreme accuracy, adaptability for unconventional set-ups or exceptionally wide range of divisions, ELLIS fills the bill.

**BUILT IN 3 SIZES**  
6½", 8" or 10" swing  
with exclusive  
floating index plate.

**NICHOLS-MORRIS CORP.**  
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ROTATING  
PARTS  
faster...  
easier...

Supersensitive Anderson Balancing Ways (Stand or Pillow Block Type) will static-balance rotating parts easier, faster, more accurately. No setup, no leveling, no centering. Glass-hard spindles and bearings prevent wear or ball-bearing indentations when balancing heavy work. Superior accuracy lasts throughout long life. Proved and preferred over 40 years.



*Anderson*  
**HAND SCRAPERS**

Anderson Hand Scrapers are: (1) faster cutting, (2) easier to use, (3) just the right spring, (4) palm fitting grip, (5) 18" - 20" - 22" lengths. Saves costly regrinding.

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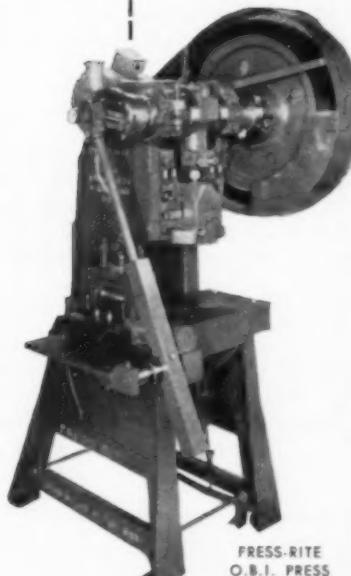
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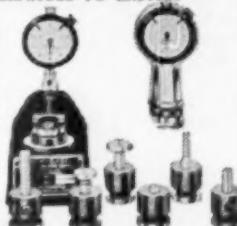
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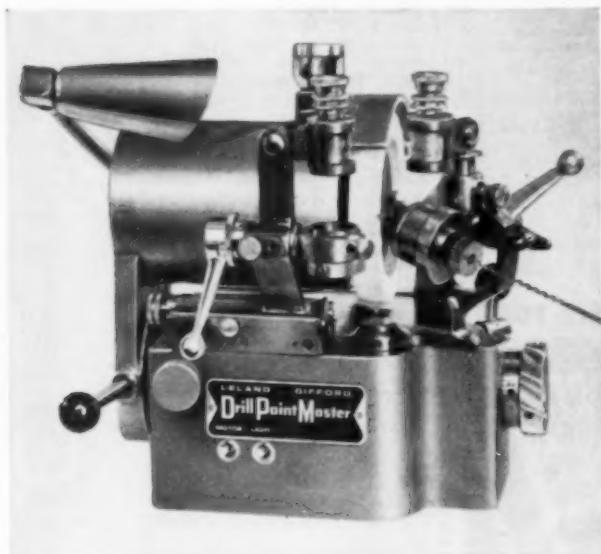
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4	9/32	1	16.15
4	5/16	1	16.55
4	7/16	1	17.80
4	9/16	1	20.75
4	11/16	1	21.80
4	13/16	1	25.20
4	15/16	1	27.75
4			28.60
4	1 - 1/8	1 - 1/4	31.20
4	1 - 1/4	1 - 1/4	34.30
5	1/4	1	21.15
5	5/16	1	21.55
5	3/8	1	23.80
5	7/16	1	25.35
5	9/16	1	28.45
5	11/16	1	31.80
5	13/16	1	34.30
5	7/8	1 - 1/4	36.90
5	15/16	1	38.40
6	1/4	1	26.05
6	5/16	1	26.70
6	3/8	1	28.65
6	7/16	1	30.55
6	9/16	1	36.06
6	11/16	1 - 1/4	38.65
6	13/16	1 - 1/4	42.40
6	7/8		43.45
6	15/16	1 - 1/4	45.55
6	1/4		46.45
6	5/16		60.10
6	3/8		61.75
6	7/16		64.95
6	1/2		66.95
6	9/16	1 - 1/4	68.50
6	5/8	1 - 1/4	68.55
6	11/16	1 - 1/4	71.80
6	13/16	1 - 1/4	74.28
6	7/8	1 - 1/4	77.40
6	15/16	1 - 1/4	81.30
10	1/4	1 - 1/2	106.32
10	5/16	1 - 1/2	107.58
10	3/8	1 - 1/2	109.30
10	1/2	1 - 1/2	107.30
10	5/8	1 - 1/2	121.70
10	3/4	1 - 1/2	140.50
10	7/8	1 - 1/2	145.15
10		1 - 1/2	150.35
12	1/2	1 - 1/2	169.35
12	5/8	1 - 1/2	186.80
12	3/4	1 - 1/2	211.90
12	7/8	1 - 1/2	242.10
12		1 - 1/2	280.25

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5	1/4	1 - 1/4	24.15
5	5/16	1 - 1/4	25.20
5	3/8	1 - 1/4	28.70
5	5/8	1 - 1/4	30.60
5	7/16	1 - 1/4	38.65
5	9/16	1 - 1/4	42.40
5	11/16	1 - 1/4	46.10
5	13/16	1 - 1/4	63.40
5	15/16	1 - 1/4	57.60
5		5/16	72.95
5		1 - 1/4	77.15
8	1/4	1 - 1/2	81.45
8	5/16	1 - 1/2	87.35
8	3/8	1 - 1/2	91.65
8	7/16	1 - 1/2	95.80
8	9/16	1 - 1/2	99.90
10	1/4	1 - 1/2	101.40
10	5/16	1 - 1/2	102.90
10	3/8	1 - 1/2	104.10
10	7/16	1 - 1/2	110.50
10	9/16	1 - 1/2	115.20
10	11/16	1 - 1/2	120.40
10	13/16	1 - 1/2	124.30
10	15/16	1 - 1/2	130.20
10		5/8	142.30
10		3/4	146.65
10		7/8	153.10
12	1/2	1 - 1/2	176.50
12	5/8	1 - 1/2	188.05
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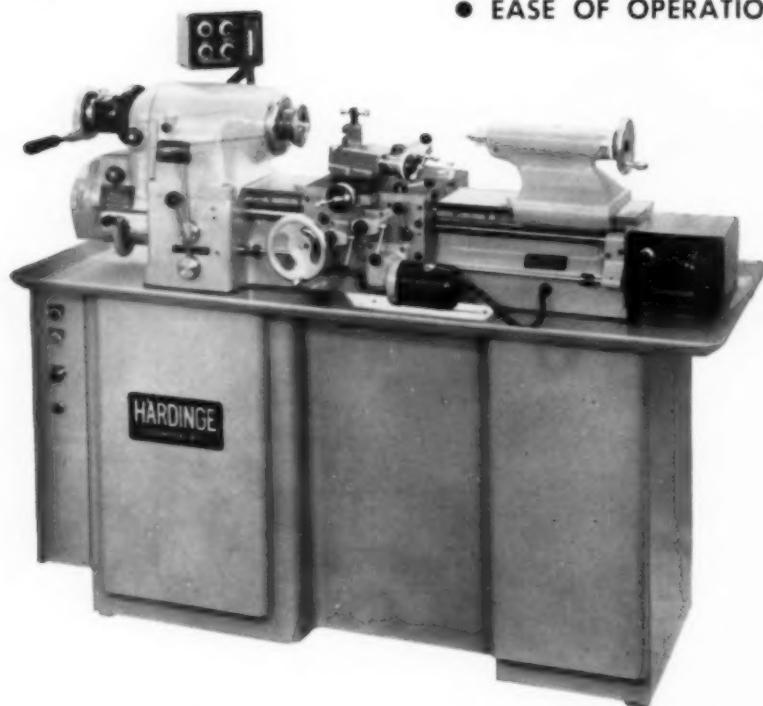
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